UM1714
User manual

Evaluation board for STM32 F0 series with STM32F072VB MCU

Introduction

The STM32072B-EVAL evaluation board is designed as complete demonstration and development platform for STMicroelectronics ARM cortex-M0 core-based STM32F072VBT6 microcontroller with two I2C, two SPI, four USART, one CAN, 12bit ADC, 12bit DAC, two GP comparators, internal 16KB SRAM and 128KB Flash, USB FS, Touch sensing, CEC, SWD debugging support.

The full range of hardware features on the board is designed for the evaluation of all the peripherals (for example the motor control connector, USB full-speed, RS232, RS485, Audio DAC, microphone ADC, Touch sensing buttons, TFT LCD, CAN, IrDA, IR LED, IR receiver, LDR, MicroSD card, CEC on two HDMI connectors, Smart card slot, RF E2PROM and the temperature sensor) and for the development of user-specific applications. Extension headers are used to easily connect a daughter board or wrapping board for the user-specific applications.

The ST-LINK/V2 is integrated on the board as embedded in-circuit debugger and programmer for the STM32 MCU.

Figure 1. STM32072B-EVAL evaluation board picture (1)

1. Picture not contractual

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1 Overview

1.1 Features

- Four 5 V power supply options: power jack, ST-LINK/V2 USB connector, user USB connector or daughter board
- Stereo audio jack which supports a headset with microphone connected to DAC and ADC of STM32F072VBT6.
- 2 G Byte (or more) SPI interface MicroSD card
- I2C compatible serial interface temperature sensor
- RF E2PROM
- RS232 and RS485 communication
- IrDA transceiver
- IR LED and IR receiver
- SWD debug support, ST-LINK/V2 embedded
- 240x320 TFT color LCD connected to SPI interface of STM32F072VBT6
- Joystick with 4-direction control and selector
- Reset and tamper buttons
- Four color user LEDs and two LEDs as MCU low power alarm
- Extension connector for daughter board or wrapping board
- MCU voltage choice fixed 3.3 V or adjustable from 1.65 V to 3.6 V
- USB full-speed connector
- Touch sensing buttons
- RTC with backup battery
- CAN2.0A/B compliant connector
- Light Dependent Resistor (LDR)
- Potentiometer
- Two HDMI connectors with DDC and CEC
- Smart Card slot
- Motor control connector

1.2 Demonstration software

The demonstration software is preloaded in the board Flash memory for easy demonstration of the device peripherals in stand-alone mode. For more information and to download the latest version available, please refer to the STM32072B-EVAL demonstration software available on www.st.com.

1.3 Order code

To order the STM32F072VBT6 evaluation board, use the order code STM32072B-EVAL.

1.4 Delivery recommendations

Before using the board for the first time, please verify that nothing was damaged during shipment and that no components are unplugged or lost.

When extracting the board from its plastic container, please check that no component remains in the bag.

The main components to verify are the following:

1. The 8 MHz crystal (X2) which may have been removed from its socket by a shock.
2. The MicroSD card which may have been ejected from the CN9 connector (right side of the board).
3. The dual-interface EEPROM board (ANT7-M24LR-A) which may have been unplugged from the CN2 connector (top left corner of the board).

For all information concerning the version of the MCU used on the board, its specification and possible related limitations, please visit the company web site to download the relevant data sheet and errata sheet.

2 Hardware layout and configuration

The STM32072B-EVAL evaluation board is designed around the STM32F072VBT6 (100-pin LQFP package). The hardware block diagram *Figure 2* illustrates the connection between STM32F072VBT6 and peripherals such as motor control connector, USB full-speed connector, RS232, RS485, Audio DAC, microphone ADC, Touch sensing buttons, TFT LCD, CAN, IrDA, IR LED, IR receiver, LDR, MicroSD card, CEC on two HDMI connectors, Smart card slot, RF E2PROM and Temperature sensor. The *Figure 3* will help you locate these features on the evaluation board.

Figure 2. Hardware block diagram

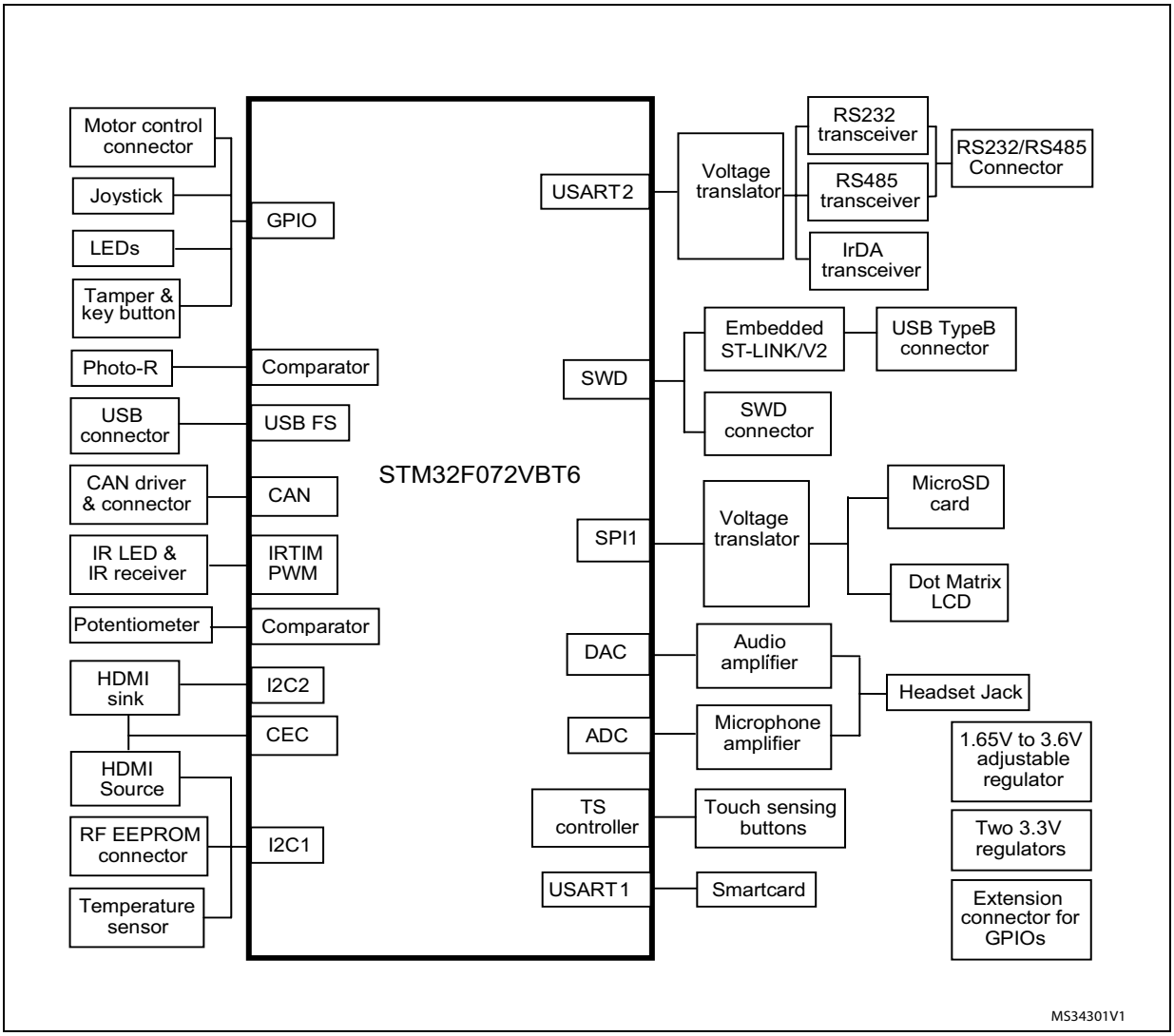
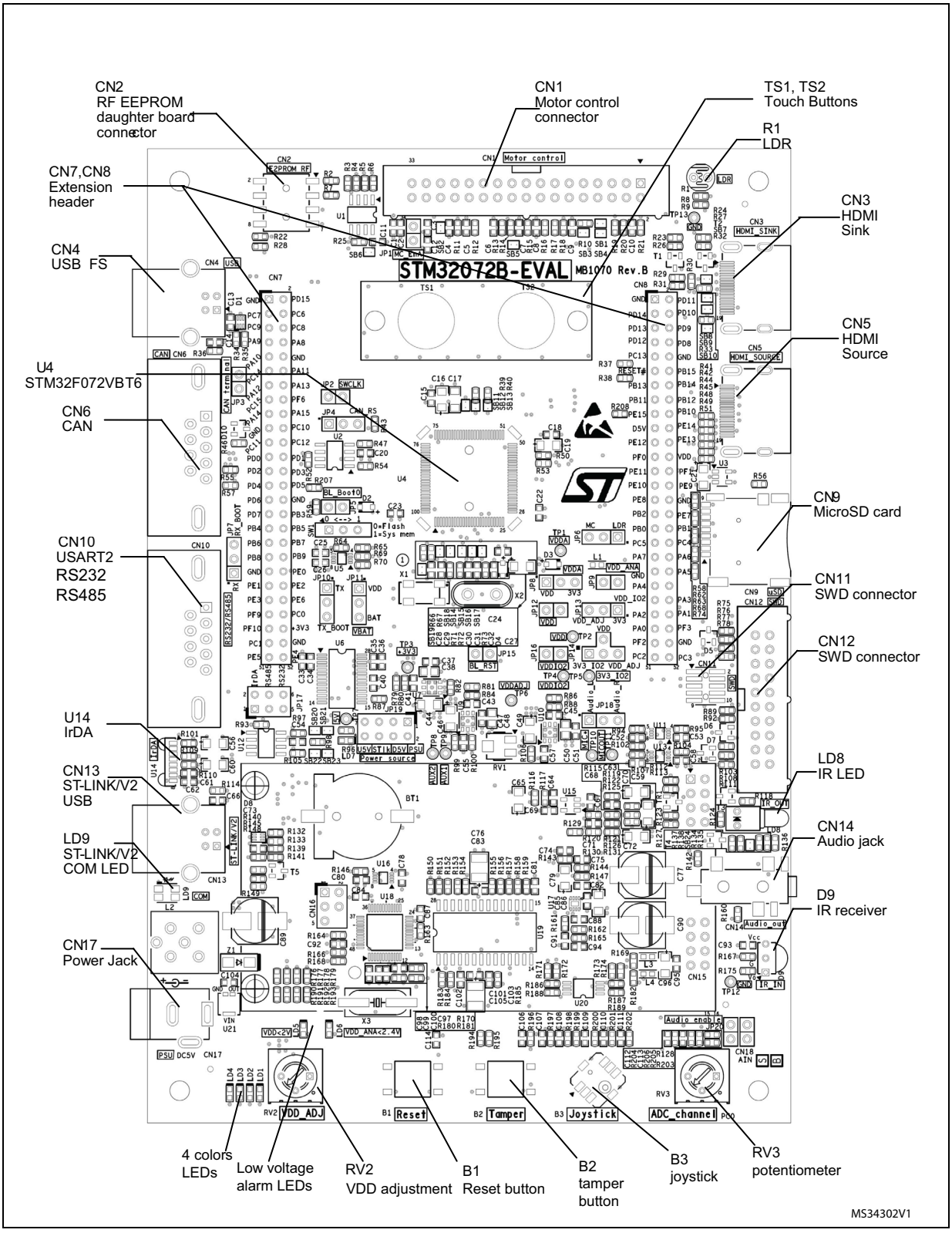


Figure 3. STM32072B-EVAL evaluation board layout



2.1 Development and debug support

The version 2 of the ST-LINK called ST-LINK/V2 is embedded on the board. This tool is used for program loading and debugging of the STM32F072VBT6 on board using the SWD interface. The third-party debug tools are also supported by SWD with connectors CN11 and CN12.

A specific driver needs to be installed on your PC for the communication with the embedded ST-LINK/V2.The install shield called ST-LINK_V2_USBdriver.exe is available on the company website. To download and install this driver, please refer to the software and development tools page for STM32F0 family available on www.st.com.

The third-party tool chains, Atollic TrueSTUDIO, KEIL ARM-MDK, IAR EWARM and the Tasking VX-Toolset support ST-LINK/V2 according to *Table 1*.

Table 1. Third-party support of ST-LINK/V2

Third party	Toolchain	Version
Atollic	TrueSTUDIO	2.1
IAR	EWARM	6.20
Keil	MDK-ARM	4.20
TaskingVX-Toolset	ARM Cortex-M	4.0.1

The embedded ST-LINK/V2 is connected to the PC via a standard USB cable connected to connector CN13.The bicolor LED LD9 (COM) indicates the status of the communication as follows:

- Slow blinking Red/Off: at power on before USB init
- Fast blinking Red/Off: after the first correct communication between the PC and ST-LINK/V2 (enumeration)
- Red Led On: when initialization between PC and ST-LINK/V2 is successfully complete
- Green Led On: after successful target communication initialization
- Blinking Red/Green: during communication with target
- Red On: communication finished and OK
- Orange On: communication failure

Note: It is possible to power the board via CN13 (embedded ST/LINK/V2 USB connector) even if an external tool is connected to CN11 (high-density SWD connector) or CN12 (SWD connector).

2.2 Power supply

The STM32072B-EVAL evaluation board is power supplied by 5V DC supply and protected by PolyZen in case of wrong power plug-in event. It is possible to configure the evaluation board to use any of the four following sources for the power supply:

- 5V DC power adapter connected to CN17, the Power Jack on the board (Power Supply Unit (PSU) on silk screen of JP19). The external power supply is not provided with the board.
- 5V DC power with 500 mA limitation from CN13, the USB type B connector of ST-LINK/V2 (USB 5 V power source (STlk) on silk screen of JP19).
- 5V DC power with 500 mA limitation from CN4, the USB type B connector (USB 5 V power source (U5V) on silk screen of JP19).
- 5V DC power from CN8, the extension connector for daughter board (daughter board power source (D5V) on silk screen of JP19).

The power source is selected by setting the related jumpers JP19, JP11 and JP14 as described in *Table 2*.

Table 2. Power source related jumpers

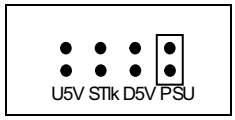
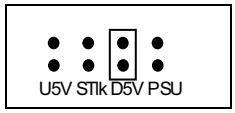
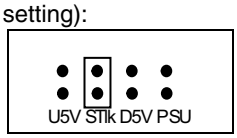
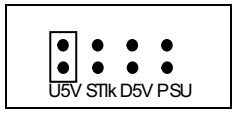
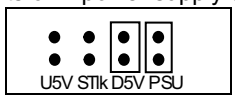
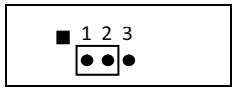
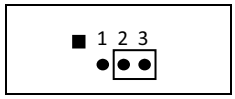
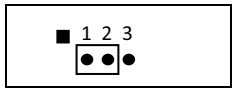
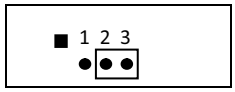
Jumper	Description
JP19	JP19 is used to select one of the four possible power supply resources. For **power supply jack**(CN17) to the STM32072B-EVAL only, JP19 is set as shown below 
	For power supply from the **daughter board connectors**(CN8) to STM32072B-EVAL only, JP19 is set as shown below: 
	For power supply from USB (CN13) of ST-LINK/V2 to STM32072B-EVAL only, JP19 is set as shown below (default setting): 
	For power supply from USB (CN4) to STM32072B-EVAL only, JP19 is set as shown below: 
	For power supply from power supply jack(CN17) to both STM32072B-EVAL and daughter board connected on CN7 and CN8, JP19 is set as shown below (the daughter board must not have its own power supply connected) 

Table 2. Power source related jumpers (continued)

Jumper	Description
JP11	The Vbat pin of STM32F072VBT6 is connected to VDD when JP11 is set as shown below (default setting): 
	The Vbat pin of STM32F072VBT6 is connected to 3V battery when JP11 is set as shown below: 
JP14	The VDDIO2 pin of STM32F072VBT6 is connected to 3.3V when JP14 is set as shown below (default setting): 
	The VDDIO2 pin of STM32F072VBT6 is connected to VDD_ADJ when JP14 is set as shown below: 

Three power modes in total are supported on the board, and can be configured by setting the related jumpers JP8, JP9, JP12, JP13 and JP16 as described in *Table 3* and the following notes.

- Mode1: The VDD and VDDA was connected together & powered by fixed 3.3V.
- Mode2: The VDD and VDDA was connected together & powered by adjustable voltage from 1.65V to 3.6V.
- Mode3: The VDD is powered by adjustable voltage from 1.65V to 3.6V while VDDA is powered by fixed 3.3V.

Table 3. Power-mode related Jumpers

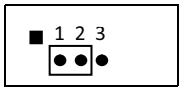
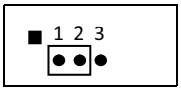
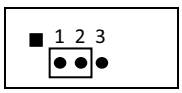
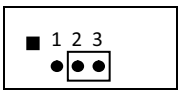
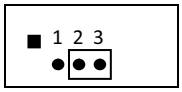
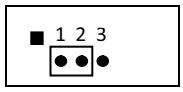
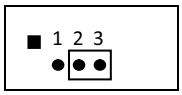
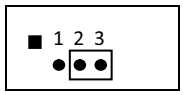
Power mode	Power mode configuration		VDD_MCU Idd measurement (on JP12)
	JP13	JP8	
Mode1			OK
			NOT allowed

Table 3. Power-mode related Jumpers

Power mode	Power mode configuration		VDD_MCU Idd measurement (on JP12)
	JP13	JP8	
Mode2			OK
Mode3			NOT allowed

Note: VDD_MCU Idd measurement can be done by the current Ammeter which is mounted on JP12 when it is open. VDDIO2 Idd measurement can be done by the current Ammeter which is mounted on JP16 when it is open.

JP9 must be open (to disconnect VDDA from all analog power VDD_ANA which is connected to analog circuits on the board) for MCU Idd measurement.

LD5 is lit when VDD<2V and in this case MCU is not functional. LD6 is lit when VDDA<2.4V and in this case analogue parts in STM32F072VBT6 are not functional.

The LED LD7 is lit when the STM32072B-EVAL evaluation board is powered by the 5V.

Table 4 shows the low-voltage limitations that might apply depending on the characteristics of some peripheral components. The components may work incorrectly when the power level is lower than the limitation.

Table 4. Low-voltage limitation

Peripheral	Component	IO name	Low-voltage limitation
Audio amplifier	U17	Audio input	2.2V(VDDA)
Microphone amplifier	U15	Audio output	2.7V(VDDA)
USB	CN4	USB	3V(VDDIO2)
CAN	CN6	CAN	3V(VDDIO2)
Smart Card	CN19	USART1	2.7V(VDDIO2)

Caution: JP12 and JP16 must not be opened; otherwise STM32F072VBT6 will be damaged due to the lack of power supply on its power pins.

Caution: There is a risk of explosion if the battery is replaced with the wrong type of battery. Dispose of used batteries according to the instructions.

2.3 Clock source

Two clock sources are available on STM32072B-EVAL evaluation board for STM32F072VBT6 and RTC embedded.

- X1, 32 kHz crystal for embedded RTC
- X2, 8 MHz crystal with socket for STM32F072VBT6 microcontroller, it can be removed from the socket when an internal RC clock is used.

Table 5. 32 kHz crystal X1 related solder bridges

Jumper	Description
SB14	PC14 is connected to 32 kHz crystal when SB14 is open. (Default setting)
	PC14 is connected to the extension connector CN7 when SB14 is closed. In this case R71 must be removed to avoid any disturbance due to the 32 kHz quartz.
SB15	PC15 is connected to the 32 kHz crystal when SB15 is open. (Default setting)
	PC15 is connected to the extension connector CN7 when SB15 is closed. In this case R72 must be removed to avoid any disturbance due to the 32 kHz quartz

Table 6. 8 MHz crystal X2 related solder bridges

Jumper	Description
SB16	PF0 is connected to the 8 MHz crystal when SB16 is open. (Default setting)
	PF0 is connected to the extension connector CN8 when SB16 is closed. In this case C31 and X2 must be removed.
SB17	PF1 is connected to the 8 MHz crystal when SB17 is open. (Default setting)
	PF1 is connected to the extension connector CN8 when SB17 is closed. In such case R73 must be removed to avoid any disturbance due to the 8 MHz quartz.

2.4 Reset source

The reset signal of STM32072B-EVAL evaluation board is low active and the reset sources include the following:

- Reset button B1
- Debugging tools from SWD connector CN11 and CN12
- Daughter board from CN8
- Embedded ST-LINK/V2
- RS232 connector CN10 for ISP.

Note: The jumper JP15 is to be closed for RESET handled by pin8 of RS232 connector CN10 (CTS signal), please look in Section 2.7 for details.

2.5 Boot option

The STM32072B-EVAL evaluation board is able to boot from the following:

- Embedded user Flash
- System memory with boot loader for ISP
- Embedded SRAM for debugging

The boot option is configured by setting the switch SW1 (BOOT0) and one option bit in Small Information block (SIF). The BOOT0 can be configured also via RS232 connector CN10.

Table 7. Boot-related switch

Switch configuration	Bit12 in user option bytes	Boot from
0 <-> 1 SW1	X	STM32072B-EVAL boot from **User Flash** when SW1 and bit12 in user option bytes set as shown on the left. (Default setting)
0 <-> 1 SW1	0	STM32072B-EVAL boot from **Embedded SRAM** when SW1 and bit12 in user option bytes set as shown on the left.
0 <-> 1 SW1	1	STM32072B-EVAL boot from **System Memory** when SW1 and bit12 in user option bytes set as shown on the left.

Table 8. Boot0-related jumpers

Jumper	Description
JP5	The Bootloader_BOOT0 is managed by pin 6 of connector CN10 (RS232 DSR signal) when JP5 is closed. This configuration is used for boot loader application only. Default Setting: Not fitted

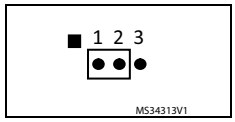
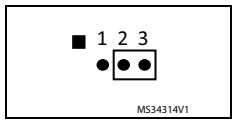
2.6 Audio

The STM32072B-EVAL evaluation board supports stereo audio playback and microphone recording by an external headset connected on the audio jack CN14. Audio play is connected to DAC output of STM32F072VBT6 through an audio amplifier and the microphone on headset is connected to ADC input of STM32F072VBT6 through a microphone amplifier. The audio amplifier can be enabled or disabled by setting JP20. Mono/stereo playback is selected by setting JP18. Refer to *Table 9* for detail.

Table 9. Audio-related jumpers

Jumper	Description
JP20	Speaker amplifier U17 is enabled when JP20 is closed (Default setting)
	Speaker amplifier U17 is disabled when JP20 is open

Table 9. Audio-related jumpers (continued)

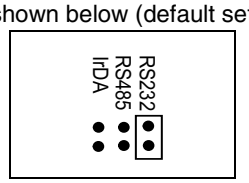
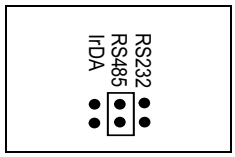
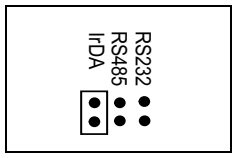
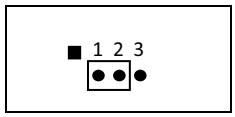
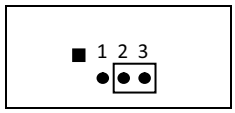
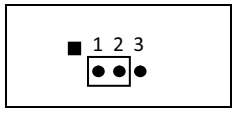
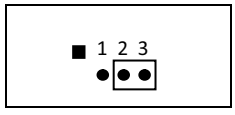
Jumper	Description
JP18	Mono playback is enabled when JP18 is set as shown below (default setting): 
	Stereo playback is enabled when JP18 is set as shown below: 

The audio amplifier operates correctly when VDDA>2.2V and the microphone amplifier operates correctly when VDDA>2.7V.

2.7 RS232, RS485 and IrDA

The communication of RS232 (with hardware flow control CTS and RTS) and RS485 is supported on D-type 9-pin connector CN10. An IrDA transceiver (U14) is connected to USART2 of the STM32F072VBT6. The signals Bootloader_RESET (shared with CTS signal) and Bootloader_BOOT0 (shared with DSR signal) are added on RS232 connector CN10 for ISP support.
The RS232 connector CN10 may be connected to either IOs of PD5 (USART2_TX) and PD6 (USART2_RX) or IOs of PA14 (TX) and PA15 (RX) on STM32F072VBT6 MCU thanks to the configuration jumpers JP7 and JP10. The bootloader is available only when RS232 connector is connected to PA14 and PA15. Please refer to *Table 10* for details.

Table 10. RS232 and IrDA related jumpers

Jumper	Description
JP17	RS232_RX is connected to RS232 transceiver and RS232 communication is enabled when JP17 is set as shown below (default setting): 
	RS485_RX is connected to RS485 transceiver and RS485 communication is enabled when JP17 is set as shown below: 
	IrDA_RX is connected to IrDA transceiver and IrDA communication is enabled when JP17 is set as shown below: 
JP10	PD5 is connected as TX signal when JP10 is set as shown to below (default setting):  *Note: bootloader is not supported with such configuration*
	PA14 is connected as TX signal when JP10 is set as shown below (JP2 must be open in this case):  *Note: bootloader is supported with such configuration*
JP7	PD6 is connected as RX signal when JP7 is set as shown below (default setting):  *Note: bootloader is not supported with such configuration*
	PA15 is connected as RX signal **with** bootloader being supported when JP7 is set as shown below:  *Note: bootloader is supported with such configuration*
JP2	SWCLK is connected to PA14 when JP2 is fitted. Default setting: Fitted

The RS485 communication is supported by RS485 transceiver ST3485EBDR which is connected to pin4 and pin9 of D-type 9-pins connectors CN10 (shared with USART2).

Table 11. RS485 related solder bridges

Jumper	Description
SB20,SB22	The external fail safe biasing are enabled when solder bridges SB20 and SB22 was closed Default setting: Not fitted
SB23	The bus termination is enabled when solder bridge SB23 is closed. Default setting: Not fitted
SB21	The AC termination is disabled when solder bridge SB21 is closed for high baud rate communication. Default setting: Not fitted

2.8 Touch sensing buttons

Two touch sensing buttons are supported on STM32072B-EVAL evaluation board. These are connected to three capacitive sensing channels (PD[12:14]) in group 8 with active shield being connected to two capacitive sensing channels (PE4 and PE5) in group 7.

Table 12. Touch sensing buttons related solder bridges

Solder Bridge	Description
SB12	PD13 is used as Touch sensing button TS2 when SB12 is open. (Default setting)
	PD13 is connected to the extension connector CN8 when SB12 is closed so touch sensing button TS2 is not usable. If necessary R39 can be removed to avoid any noise.
SB13	PD12 is used as Touch sensing button TS1 when SB13 is open (Default setting)
	PD12 is connected to the extension connector CN8 when SB12 is closed so touch sensing button TS1 is not usable. If necessary R40 can be removed to avoid any noise.
SB11	PD14 is disconnect from the extension connector CN8 when SB11 is open (default setting). In such case this IO is used as charge transfer pin connected to C17 for the touch sensing application. (Default setting)
	PD14 is connected to extension connector CN8 when SB11 is closed. In such case C17 must be removed to avoid disturbance due to the capacitor
SB19	PE4 is disconnect from extension connector CN7 when SB19 is open (default setting). In such case this IO is used as active shield for Touch sensing buttons TS1 & ST2.
	PE4 is connected to the extension connector CN7 when SB19 is closed. In such case R66 must be removed to avoid disturbance due to the shield
SB18	PE5 is disconnect from the extension connector CN7 when SB18 is open (default setting). In such case this IO is used to manage the Shield capacitor C28 for the touch sensing application.
	PE5 is connected to the extension connector CN7 when SB19 is closed. In this case R67 must be removed to avoid any disturbance due to the capacitor

Note: the touch sensing buttons are fully functional only when STM32072B-EVAL is powered in power mode 1 (both VDD & VDDA is connected to fixed 3.3 V). It is potentially necessary to adjust the capacitor value of C28 and the firmware to adapt them to the voltage range from 1.65 V to 3.6 V of VDD in power modes 2 and 3.

2.9 MicroSD card

The 2 GB (or more) MicroSD card is available on the board. It is connected to SPI1 port (shared with color LCD) of STM32F072VBT6. The MicroSD card detection is managed by the standard IO port PB15 and it should be set with internal pull-up.

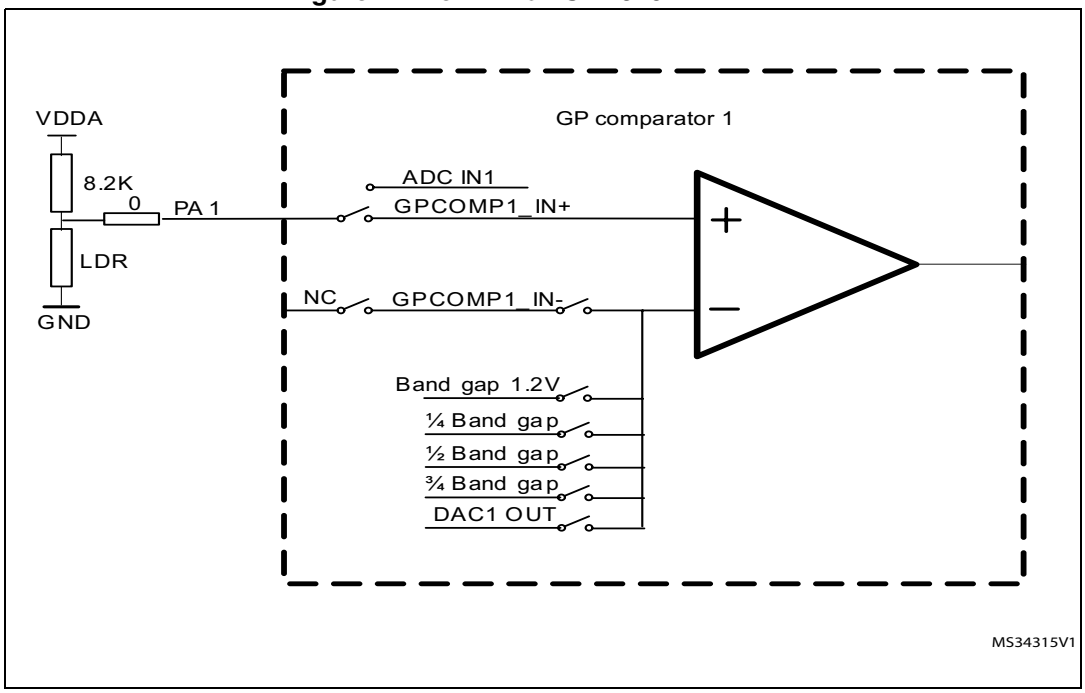
2.10 Analog input

The two-pin header CN18 and the 10K ohm potentiometer RV3 are connected to PC0 of STM32F072VBT6 as analog input. A low pass filter can be implemented by replacing R206 and C113 with the right values of resistor and capacitor as requested by end user application.

2.11 LDR (Light Dependent Resistor)

The VDDA is divided by the resistor bridge of LDR VT9ON1 and 8.2K resistor, and connected to PA1 (COM1_IN+/ADC IN1) as shown below on the STM32072B-EVAL evaluation board.

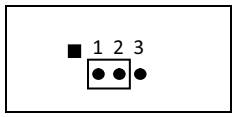
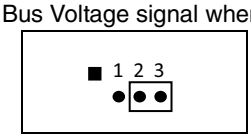
Figure 4. The LDR on STM32072B-EVAL



It is possible to compare LDR output with 1/4 band gap, 1/2 band gap, 3/4 band gap, band gap and DAC1 OUT, and to connect LDR output to ADC IN1 for AD conversion.

PA1 is also shared with the motor control bus voltage signal and its input source can be selected by setting JP6 in *Table 13*.

Table 13. LDR related jumpers

Jumper	Description
JP6	PA1 is used as LDR input when JP6 is set as shown below (default setting): 
	PA1 is used as motor control Bus Voltage signal when JP6 is set as shown below: 

2.12 Temperature sensor

A temperature sensor STLM75M2F is connected to I2C1 bus of STM32F072VBT6, and shares the same I2C1 bus with RF E2PROM and DDC on HDMI_Source connector CN5.

The I2C address of the temperature sensor is 0b100100x, where x can be 0 or 1 depending on the setting of SB6.

Table 14. Temperature sensor related solder bridge

Solder Bridge	Description
SB6	I2C address A0 is 0 when SB6 is open. (Default setting)
	I2C address A0 is 1 when SB6 is closed.

Note: the temperature result measured from STLM75M2F can be a little higher than the ambient temperature due to the power dissipation of the components on the board.

2.13 USB

STM32072B-EVAL evaluation board supports USB2.0 compliant full speed communication via a USB type B connector (CN4). The evaluation board can be powered by this USB connection at 5 V DC with 500 mA current limitation.

USB operates correctly when VDDIO2>3V.

2.14 Smart card

STMicroelectronics smart card interface circuit ST8024L is used on STM32072B-EVAL evaluation board for asynchronous 1.8 V, 3 V and 5 V smart cards. It performs all the supply protection and control functions based on the connections with STM32F072VBT6 listed in *Table 15*.

Table 15. Connection between ST8024L and STM32F072VBT6

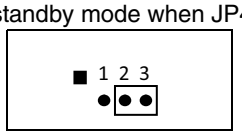
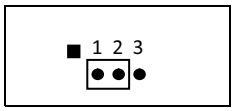
Signals of ST8024L	Description	Connect to STM32F072VBT6
5V/3V	Smart card power supply selection pin	PC11
I/OUC	MCU data I/O line	PA9
XTAL1	Crystal or external clock input	PA8
OFF	Detect presence of a card, Interrupt to MCU	PC12
RSTIN	Card Reset Input from MCU	PA10
CMDVCC	Start activation sequence input (Active Low)	PD2
1.8V	1.8 V Vcc operation selection. Logic high selects 1.8 V operation and overrides any setting on the 5V/3V pin.	PC10

The smart card operates correctly when VDDIO2>2.7V.

2.15 CAN

STM32072B-EVAL evaluation board supports one channel of CAN2.0A/B complaint CAN bus communication based on 3.3V CAN transceiver. The High-speed mode, standby mode and slope control mode are available and can be selected by setting JP4.

Table 16. CAN related jumpers

Jumper	Description
JP4	CAN transceiver is working in standby mode when JP4 is set as shown below: 
	CAN transceiver is working in high-speed mode when JP4 is set as shown below: (default setting) 
	CAN transceiver is working in slope control mode when JP4 is open.
JP3	CAN terminal resistor is enabled when JP3 is fitted. Default setting: Not fitted

CAN operates correctly when VDDIO2>3V.

2.16 RF E2PROM

An RF E2PROM module ANT7-M24LR-A is mounted on connector CN2 and connected to I2C1 bus of STM32F072VBT6, this bus shares the same I2C1 bus with the temperature sensor U1 and DDC on HDMI_Source connector CN5.

2.17 HDMI CEC

Two HDMI connectors CN3 and CN5 are available on STM32072B-EVAL board.

- The connector CN3 is HDMI sink connector with the following:
  - DDC connected to I2C2 of STM32F072VBT6
  - HPD controlled by IO PD15 through transistor T1
  - CEC connected to PB8 through transistor T2.
- The connector CN5 is HDMI source connector with the following:
  - DDC connected to I2C1 of STM32F072VBT6 and shared with the temperature sensor and RF E2PROM
  - HPD controlled by IO PE0
  - CEC connected to PB8 through the transistor T2
  - HDMI 5 V powered by power switch U3

The signals TDMS D+[0..2], TDMS_CLK+, TDMS D-[0..2], TDMS_CLK- on these two HDMI connectors are connected together.

The CEC injector mode can be enabled by some PCB reworks for debugging purpose only:

- Remove resistors R29, R31, R33, R42, R44, R48 and R51.
- Close solder bridges SB7, SB8, SB9 and SB10.

Note: the I/O PD15 must be set in open-drain output mode by firmware when working as an HPD signal control on the HDMI sink connector CN3.

2.18 IR LED and IR receiver

The IR receiver TSOP34836 is connected to PC6 of STM32F072VBT6 and a current around 100 mA on IR LED is driven by PB9 through the transistors T3 and T4 on the board.

Note: the IR LED may be driven by PB9 directly with 20 mA current when SB24 is closed and R138 is removed.

2.19 Motor control

STM32072B-EVAL evaluation board supports both asynchronous and synchronous three-phase brushless motor control via a 34-pins connector CN1 that provides all the required control and feedback signals to and from the motor power-driving board. The available signals on this connector include emergency stop, motor speed, three phase motor currents, bus voltage, heat sink temperature coming from the motor driving board and six channels of PWM control signal going to the motor driving circuit.

Table 17. Motor control related jumpers

Jumper	Description
JP6	The description of JP6 is in *Section 2.11: LDR (Light Dependent Resistor)*
JP1	JP1 should be kept on open when the encoder signal is from pin31 of the motor control connector CN1 while it should be kept on close when the analog signal is from pin31 of CN1 for the special motor. Default setting: Not fitted
SB1	The pin1 of motor connector CN1 is connected to PA1 as MC_EmergencySTOP3 when SB1 is closed. Default setting: open
SB2	The special motor current sampling operation is enabled when SB2 is closed (PC8 connected to PF3). The IO pins PC8 and PF3 are disconnected and can be used by the daughter board when SB2 is open. Default setting: open
SB3	The pin14 of motor connector CN1 is connected to PC3 as MC_BusVoltage2 when SB3 is closed. In such case R10 should be removed. Default setting: open
SB4	The pin1 of motor connector CN1 is connected to PA3 as MC_EmergencySTOP2 when SB4 is closed. Default setting: open
SB5	The pin17 of motor connector CN1 is connected to PA3 as MC_CurrentB2 when SB5 is closed. Default setting: open

Note: the solder bridges SB4 and SB5 must not be closed at the same time. Also, SB1 and R10 must not be fitted at the same time.

2.20 Display and input devices

The 2.4” color TFT LCD connected to SPI1 port of STM32F072VBT6 and the four general purpose color LEDs (LD 1,2,3,4) are available as display device. Two push buttons (B1 Reset, B2 tamper) and one joystick are available. The selection key of the joystick is connected to PA0 which supports the wake-up feature.

Table 18. LCD modules

2.4” TFT LCD connector CN15					
Pin	**Description**	**Pin connection**	**Pin**	**Description**	**Pin connection**
1	CS	PE6	9	VDD	3.3V
2	SCL	PB3	10	VCI	3.3V
3	SDI	PE15	11	GND	GND
4	RS	-	12	GND	GND
5	WR	-	13	BL_VDD	5V
6	RD	-	14	BL_Control	5V

Table 18. LCD modules (continued)

2.4” TFT LCD connector CN15					
Pin	**Description**	**Pin connection**	**Pin**	**Description**	**Pin connection**
7	SDO	PE14	15	BL_GND	GND
8	RESET	RESET#	16	BL_GND	GND

Note: A bidirectional voltage translator (U13) is implemented on SPI_MOSI signal between the MCU and LCD in order to support the 3-wire serial interface required by several TFT-LCD controllers. The direction of the voltage translator is controlled by IO PB2 (the IO PE15 is working as MOSI when PB2 is high or as MISO when PB2 is LOW).

3 Connectors

3.1 Motor control connector CN1

Figure 5. Motor control connector CN1

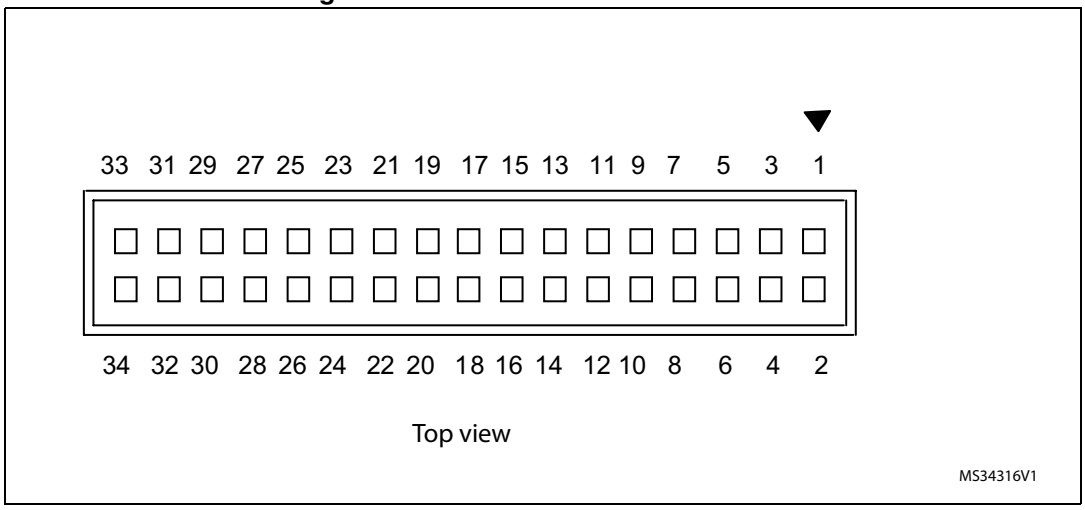


Table 19. Motor control connector CN1(1)

Description	Pin of STM32F072VB	Pin number of CN1	Pin number of CN1	Pin of STM32F072VB	Description
Emergency STOP	PB12 (R20 mounted by default)	1	2		GND
Emergency STOP2	PA3 (to close SB4)				
Emergency STOP3	PA1 (to close SB1)				
PWM-UH	PE9	3	4		GND
PWM-UL	PE8	5	6		GND
PWM-VH	PE11	7	8		GND
PWM-VL	PE10	9	10		GND
PWM-WH	PE13	11	12		GND
PWM-WL	PE12	13	14	PA1 (R10 mounted by default)	BUS VOLTAGE
				PC3 (to close SB3)	BUS VOLTAGE2
PHASE A CURRENT	PA2	15	16		GND
PHASE B CURRENT	PC5 (R14 mounted by default)	17	18		GND
PHASE B CURRENT2	PA3 (to close SB5)				

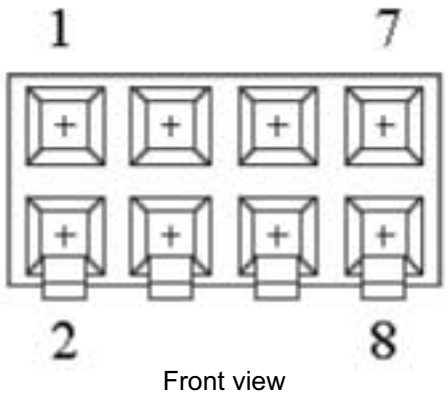
Table 19. Motor control connector CN1(1) (continued)

Description	Pin of STM32F072VB	Pin number of CN1	Pin number of CN1	Pin of STM32F072VB	Description
PHASE C CURRENT	PC4	19	20		GND
NTC BYPASS RELAY	PE7	21	22		GND
DISSIPATIVE BRAKE PWM	PB11	23	24		GND
+5V power		25	26	PC2	Heatsink temperature
PFC SYNC2	PC8 (Always be connected)	27	28		3.3V power
PFC SYNC1	PF3 (to close SB2)				
PFC PWM	PC9	29	30		GND
Encoder A	PA6	31	32		GND
Encoder B	PA7	33	34	PB0	Encoder Index

1. The signals in the grey table cells are not connected by default.

3.2 RF E2PROM connector CN2

Figure 6. RF EEPROM daughter board connector CN2



Front view

MS34317V1

Table 20. RF E2PROM connector CN2

Pin number	Description	Pin number	Description
1	I2C1_SDA (PB7)	5	+5V
2	NC	6	NC
3	I2C1_SCL (PB6)	7	GND
4	EX_RESET(PD7)	8	NC

3.3 HDMI sink connector CN3

Figure 7. HDMI Sink connectors CN3

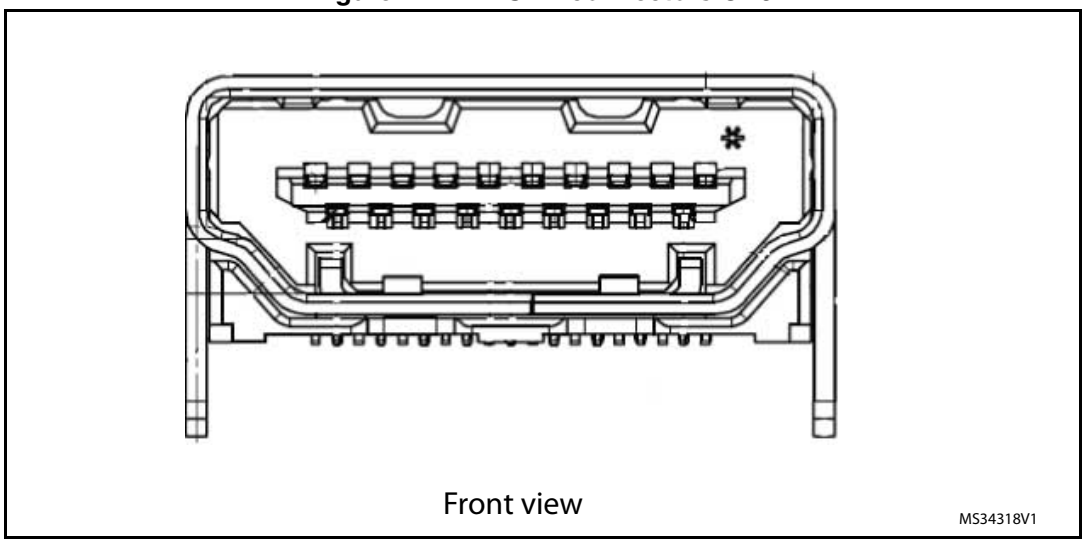
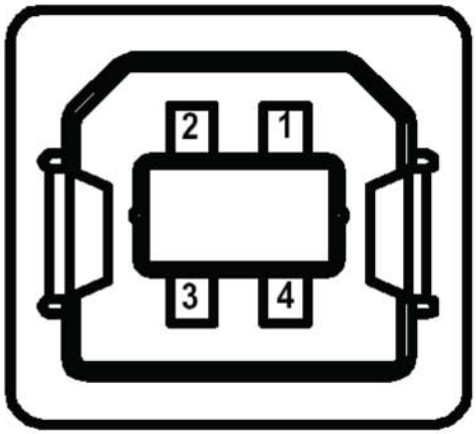


Table 21. HDMI Sink connectors CN3

Pin number	Description	Pin number	Description
1,3,4,6,7,9,10,12	TMDS differential signal pair connected to CN5	16	I2C2_SDA (PB14)
13	CEC (PB8)	2,5,8,11,17	GND
14	NC	18	HDMI_5V_Sink
15	I2C2_SCL (PB13)	19	HPD (PD15 through transistor)

3.4 User USB type B connector CN4

Figure 8. USB type B connector CN4



Front view

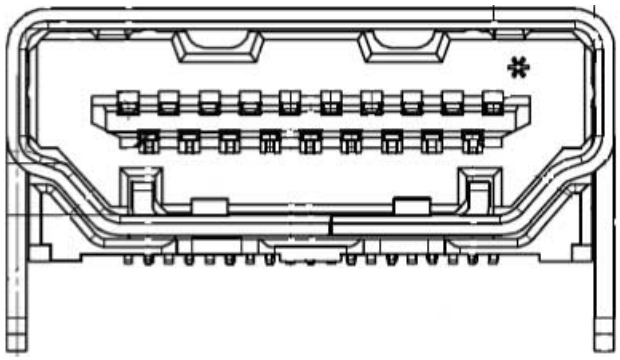
MS34319V1

Table 22. USB type B connector CN4

Pin number	Description	Pin number	Description
1	VBUS(power)	4	GND
2	DM(PA11)	5,6	Shield
3	DP(PA12)		

3.5 HDMI source connector CN5

Figure 9. HDMI source connectors CN5



Front view

MS34320V1

Table 23. HDMI Source connectors CN5

Pin number	Description	Pin number	Description
1,3,4,6,7,9,10,12	TMDS differential signal pair connected to CN3	16	I2C1_SDA (PB7)
13	CEC (PB8)	2,5,8,11,17	GND
14	NC	18	HDMI_5V_Source from power switch U3
15	I2C1_SCL (PB6)	19	HPD (PE0)

0.1 CAN D-type and 9-pin male connector CN6

Figure 10. CAN D-type and 9-pin male connector CN6

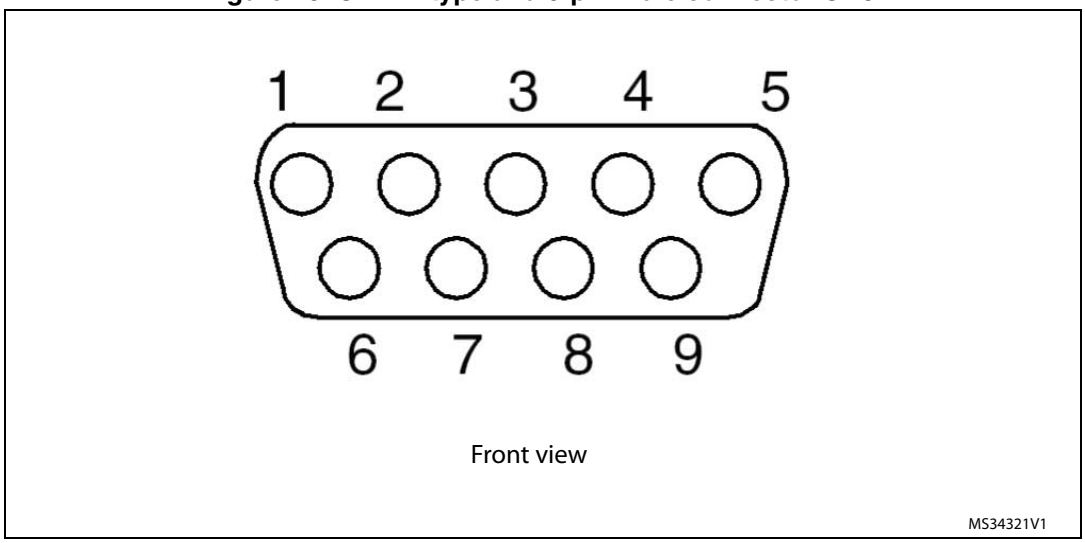


Table 24. CAN D-type and 9-pin male connector CN6

Pin number	Description	Pin number	Description
1,4,8,9	NC	7	CANH
2	CANL	3,5,6	GND

3.6 Daughter board extension connector CN7 and CN8

Two 52-pin male headers CN7 and CN8 can be used to connect with the daughter board or with the standard wrapping board to STM32072B-EVAL evaluation board. All GPI/Os are available on the connector. The space between these two connectors and position of power, GND and RESET pin are defined as a standard, allowing the development of common daughter boards for several evaluation boards. The standard width between CN7 pin1 and CN8 pin1 is 2700mils (68.58mm). The standard was implemented on the majority of evaluation boards.

Each pin on CN7 and CN8 can be used by a daughter board after disconnecting it from the corresponding function block on STM32072B-EVAL evaluation board. Please look at *Table 25* and *Table 26* for details.

Table 25. Daughter board extension connector CN7

Pin	Description	Alternative function	How to disconnect with function block on STM32072B-EVAL board
1	GND	-	-
3	PC7	-	-
5	PC9	MC_PFCpwm	Disconnect MC power board from CN1
7	PA9	SmartCard_IO	Remove R152
9	PA10	SmartCard_RST	Remove R155
11	PC14	OSC32_IN	Remove R71, Close SB14
13	PA12	USB_DP	Remove R34
15	PC15	OSC32_OUT	Remove R72, Close SB15
17	PA14	SWCLK / USART2_TX_BOOT	Keep JP2, JP10 open
19	GND	-	-
21	PC11	SmartCard_3/5V	Remove R184
23	PD0	CAN_RX	Remove R47
25	PD2	SmartCard_CMDVCC	Remove R156
27	PD4	USART2_RTS/RS485_DIR	Remove R65
29	PD6	USART2_RX	Keep JP7 open
31	PD7	EX_RESET	Remove R28
33	PB4	-	-
35	PB6	I2C1_SCL	Remove R5,R7,R41,R42
37	PB8	HDMI_CEC	Remove R27
39	GND	-	-
41	PE1	-	-
43	PE3	JOY_RIGHT	Remove R202
45	PF9	JOY_UP	Remove R200
47	PF10	JOY_DOWN	Remove R197
49	PC1	Audio_IN	Remove R129
51	PE5	SHIELD_CT	Remove R67, Close SB18
2	PD15	HDMI_HPD_SINK	Remove R23
4	PC6	IR_IN	Remove R175
6	PC8	MC_PFCsync2	Disconnect MC power board from CN1, Keep SB2 open
8	PA8	SmartCard_CK	Remove R153

Table 25. Daughter board extension connector CN7 (continued)

Pin	Description	Alternative function	How to disconnect with function block on STM32072B-EVAL board
10	GND	-	-
12	PA11	USB_DM	Remove R35
14	PA13	SWDAT	Remove R76
16	PF6	-	-
18	PA15	USART2_RX_BOOT	Keep JP7 open
20	PC10	SmartCard_1.8V	Remove R159
22	PC12	SmartCard_OFF	Remove R154
24	PD1	CAN_TX	Remove R54
26	PD3	USART2_CTS	Remove R87
28	PD5	USART2_TX	Remove R69
30	GND	-	-
32	PB3	SPI1_SCK	Remove R95
34	PB5	TempSensor_INT	Remove R4
36	PB7	I2C1_SDA	Remove R2,R6,R44,R45
38	PB9	IR_OUT	Remove R135
40	PE0	HDMI_HPD_Source	Remove R49
42	PE2	JOY_LEFT	Remove R199
44	PE6	LCD_CS	Remove R113
46	PC0	Potentiometer	Remove R204
48	+3V3	-	-
50	GND	-	-
52	PE4	SHIELD	Remove R66, Close SB19

Table 26. Daughter board extension connector CN8

Pin	Description	Alternative Function	How to disconnect with function block on STM32072B-EVAL board
1	GND	-	-
3	PD14	TS_CT	Remove C17, Close SB11
5	PD13	TS2	Remove R39, Close SB12
7	PD12	TS1	Remove R40, Close SB13
9	PC13	TAMPER_KEY	Remove R194
11	RESET#	-	-
13	PB13	I2C2_SCL	Remove R30
15	PB11	MC_Dissipativebrake	Disconnect MC power board from CN1

Table 26. Daughter board extension connector CN8 (continued)

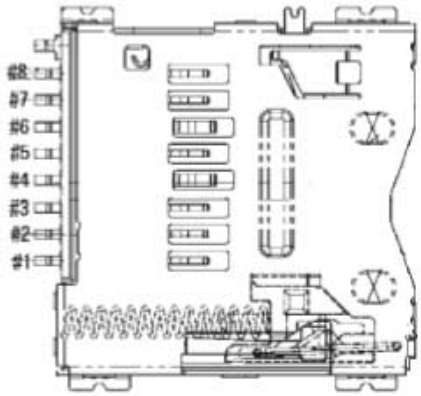
Pin	Description	Alternative Function	How to disconnect with function block on STM32072B-EVAL board
17	PE15	SPI1_MOSI	Remove R104
19	D5V	-	-
21	PE12	MC_WL	Disconnect MC power board from CN1
23	PF0	OSC_IN	Remove X2,C31, Close SB16
25	PE11	MC_VH	Disconnect MC power board from CN1
27	PE10	MC_VL	Disconnect MC power board from CN1
29	PE8	MC_UL	Disconnect MC power board from CN1
31	PB2	SPI1_MOSI_DIR	Remove R102
33	PB0	MC_Enindex	Disconnect MC power board from CN1
35	PC5	MC_Current B	Remove R14
37	PA7	MC_Encoder B	Disconnect MC power board from CN1
39	GND	-	-
41	PA4	Audio_OUT_LEFT	Keep JP18 open
43	VDD_IO2	-	-
45	PA2	MC_Current A	Remove R16
47	PA0	JOY_SEL	Remove R198
49	PF2	MicroSD_CS	Remove R74
51	PC2	MC_headsinkTemp	Remove R11
2	PD11	LED4	Remove R176
4	PD10	LED3	Remove R177
6	PD9	LED2	Remove R178
8	PD8	LED1	Remove R179
10	GND	-	-
12	PB15	SDcard_detect	Remove R56
14	PB14	I2C2_SDA	Remove R32
16	PB12	MC_EmergencySTOP	Remove R20
18	PB10	USB_VBUS_detection	Remove R50,R53
20	PE14	SPI1_MISO	Remove R58
22	PE13	MC_WH	Disconnect MC power board from CN1
24	VDD	-	-
26	PF1	OSC_OUT	Remove R73, Close SB17
28	PE9	MC_UH	Disconnect MC power board from CN1
30	GND	-	-
32	PE7	MC_ NTC	Disconnect MC power board from CN1

Table 26. Daughter board extension connector CN8 (continued)

Pin	Description	Alternative Function	How to disconnect with function block on STM32072B-EVAL board
34	PB1	-	-
36	PC4	MC_Current C	Remove R13
38	PA6	MC_Encoder A	Keep JP1 open, Disconnect MC power board from CN1
40	PA5	Aduio_OUT_RIGHT	Keep JP18 open
42	NC	-	-
44	PA3	MC_Current B2/ MC_Emergency_STOP2	Keep SB4,SB5 open
46	PA1	LDR_IN/MC_BusVoltage / MC_Emergency_STOP3	Keep JP6 open
48	PF3	MC_PFCsync1	Keep SB2 open
50	GND	-	-
52	PC3	MC_BusVoltage2	Keep SB3 open

3.7 MicroSD connector CN9

Figure 11. MicroSD connector CN9



Front view

MS34322V1

Table 27. MicroSD connector CN9

Pin number	Description	Pin number	Description
1	NC	5	MicroSDcard_CLK (PB3)
2	MicroSDcard_CS (PF2)	6	Vss/GND
3	MicroSDcard_DIN(PE15)	7	MicroSDcard_DOUT(PE14)

Table 27. MicroSD connector CN9 (continued)

Pin number	Description	Pin number	Description
4	+3V3	8	NC
		10	MicroSDcard_detect (PB15)

3.8 RS232 and RS485 connector CN10

Figure 12. RS232 and RS485 connector CN10

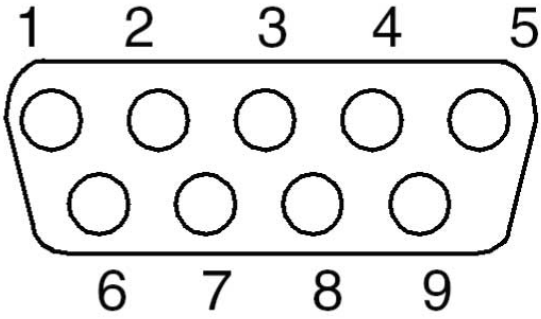


Table 28. RS232 and RS485 connector CN10

Pin number	Description	Pin number	Description
1	NC	6	Bootloader_BOOT0
2	RS232_RX (PD6 or PA15)	7	RS232_RTS(PD4)
3	RS232_TX (PD5 or PA14)	8	RS232_CTS(PD3)/Bootloader_RESET
4	RS485_A	9	RS485_B
5	GND		

3.9 High-density SWD connector CN11

Figure 13. High-density SWD debugging connector CN11

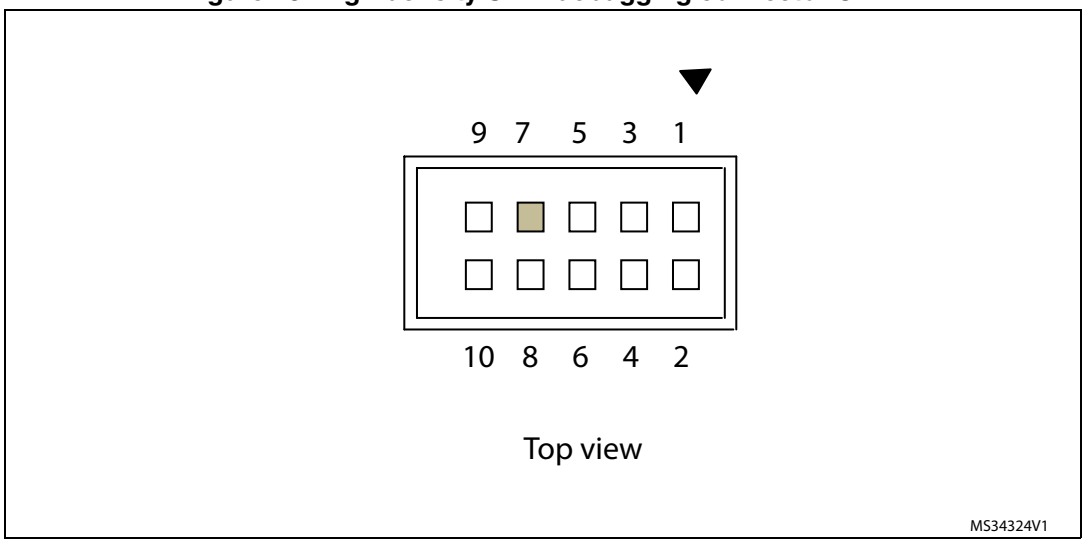


Table 29. High-density SWD debugging connector CN11

Pin number	Description	Pin number	Description
1	VDDIO2	2	SWDAT(PA13)
3	GND	4	SWCLK(PA14)
5	GND	6	NC
7	KEY	8	NC
9	GND	10	RESET#

3.10 Standard SWD connector CN12

Figure 14. Standard SWD debugging connector CN12

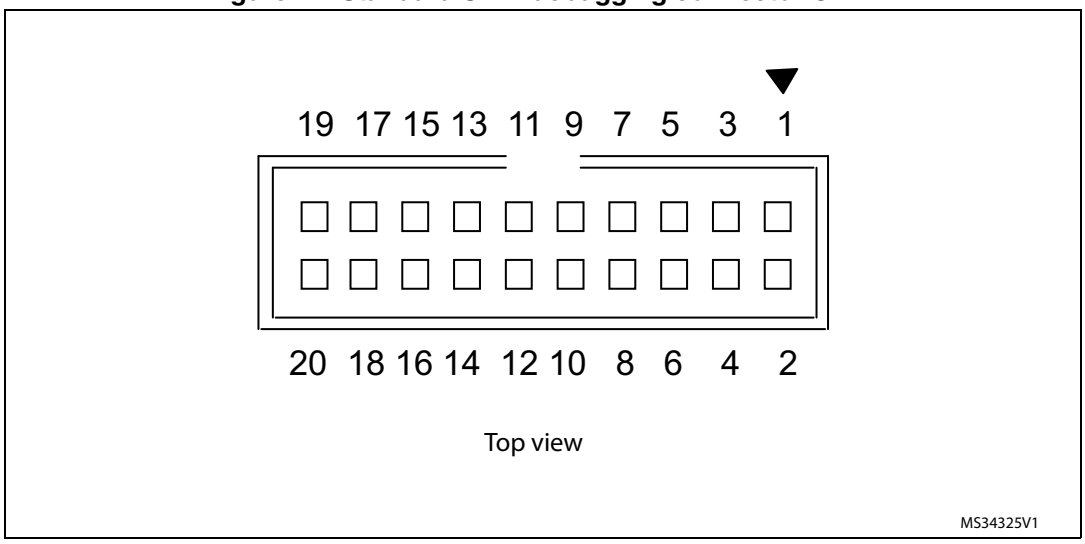


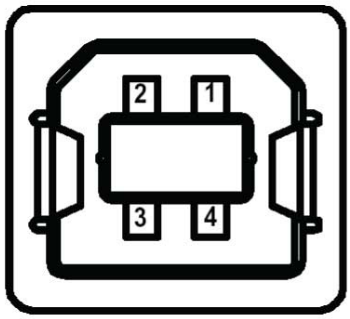
Table 30. Standard SWD debugging connector CN12

Pin number	Description	Pin number	Description
1	VDDIO2	2	VDDIO2
3	NC	4	GND
5	NC	6	GND
7	SWDAT(PA13)	8	GND
9	SWCLK(PA14)	10	GND
11	10K pull-down	12	GND
13	NC	14	GND
15	RESET#	16	GND
17	10K pull-down	18	GND
19	10K pull-down	20	GND

3.11 ST-LINK/V2 USB type B connector CN13

The USB connector CN13 is used to connect embedded ST-LINK/V2 to PC for debugging of board.

Figure 15. USB type B connector CN13



Front view

MS34326V1

Table 31. USB type B connector CN13

Pin number	Description	Pin number	Description
1	VBUS(power)	4	GND
2	DM	5,6	Shield
3	DP		

3.12 Audio jack CN14

A 3.5 mm stereo audio jack CN14 is available on STM32072B-EVAL board. It is connected to audio DAC and ADC.

3.13 TFT LCD connector CN15

A TFT color LCD board is mounted on CN15. Please refer to *Section 2.20* for details.

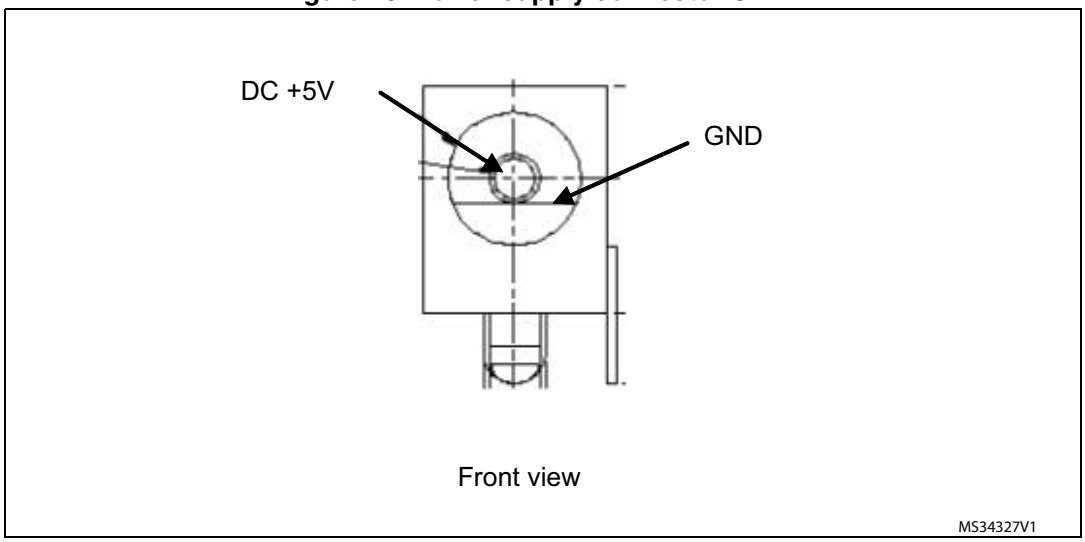
3.14 ST-LINK/V2 programming connector CN16

The connector CN16 is used only for the embedded ST-LINK/V2 programming during board manufacture. It is not populated by default and not for end users.

3.15 Power connector CN17

The STM32072B-EVAL evaluation board can be powered from a DC 5V power supply via the external power supply jack (CN17) shown in *Figure 16*. The central pin of CN17 must be positive.

Figure 16. Power supply connector CN17



3.16 Analog input connector CN18

Figure 17. Analog input-output connector CN18

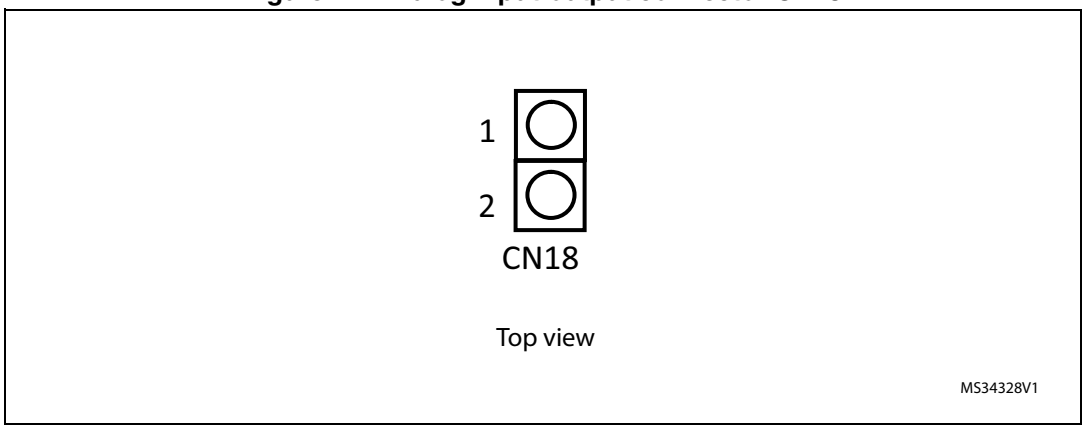


Table 32. Analog input-output connector CN18

Pin number	Description	Pin number	Description
1	Analog input-output PC0	2	GND

3.17 Smart card connector CN19

Figure 18. Smart card connector CN19

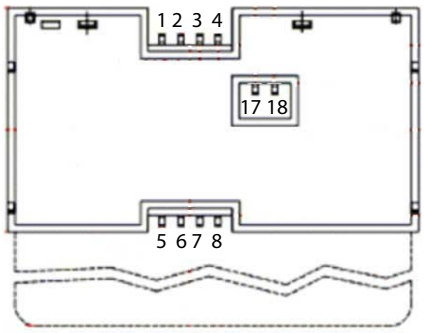


Table 33. Smart card connector CN19

Pin number	Description	Pin number	Description
1	VCC	5	GND
2	RST	6	NC
3	CLK	7	I/O
4	NC	8	NC
17	Detection pin of card presence	18	Detection pin of card presence

4 Schematics

The schematics of STM32072B-EVAL are shown in the *Figure 19* to *Figure 32*.

The schematic of the TFT LCD daughter board is shown in *Figure 33*.

Figure 19. STM32072B-EVAL schematic 1

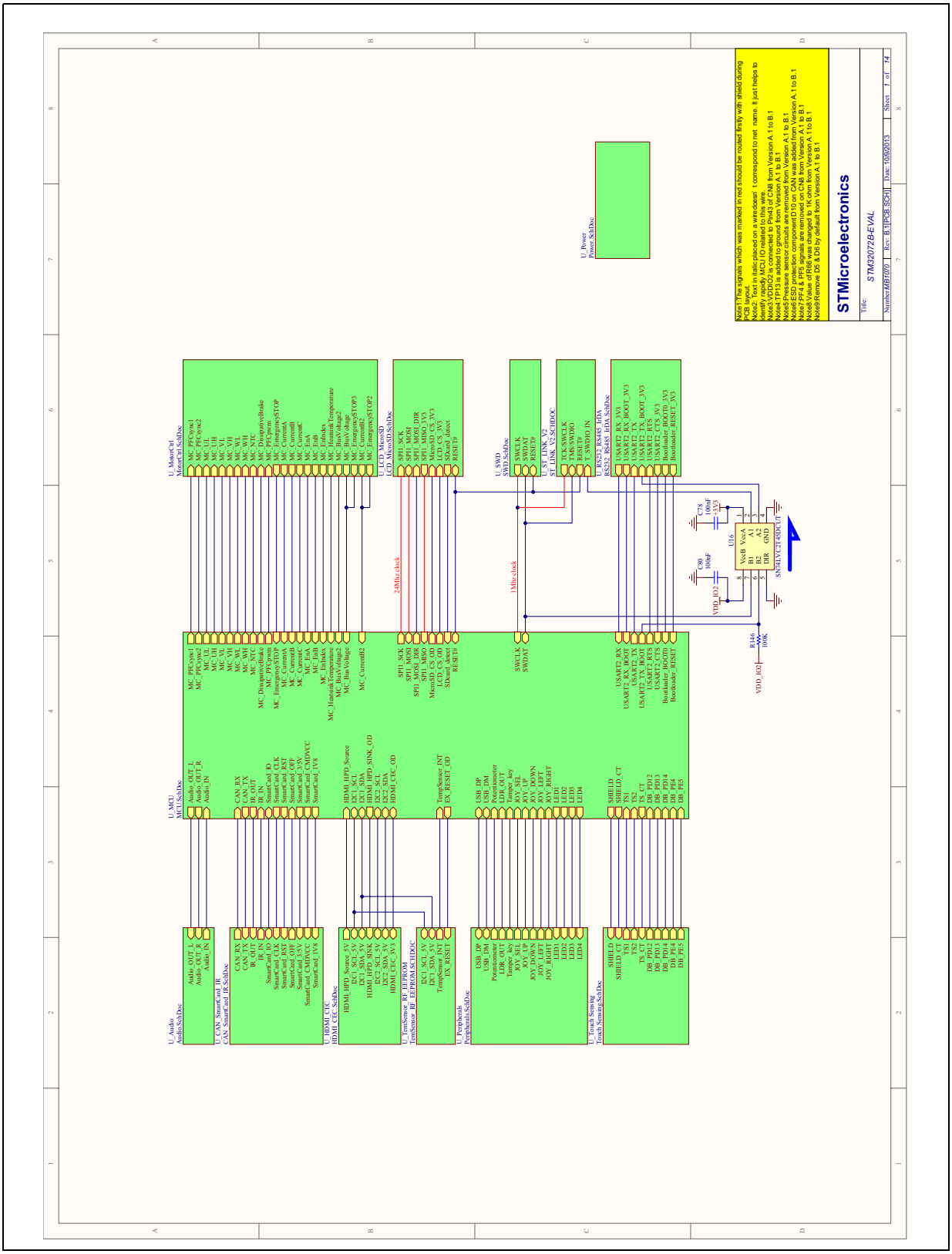


Figure 20. STM32072B-EVAL MCU schematic 2

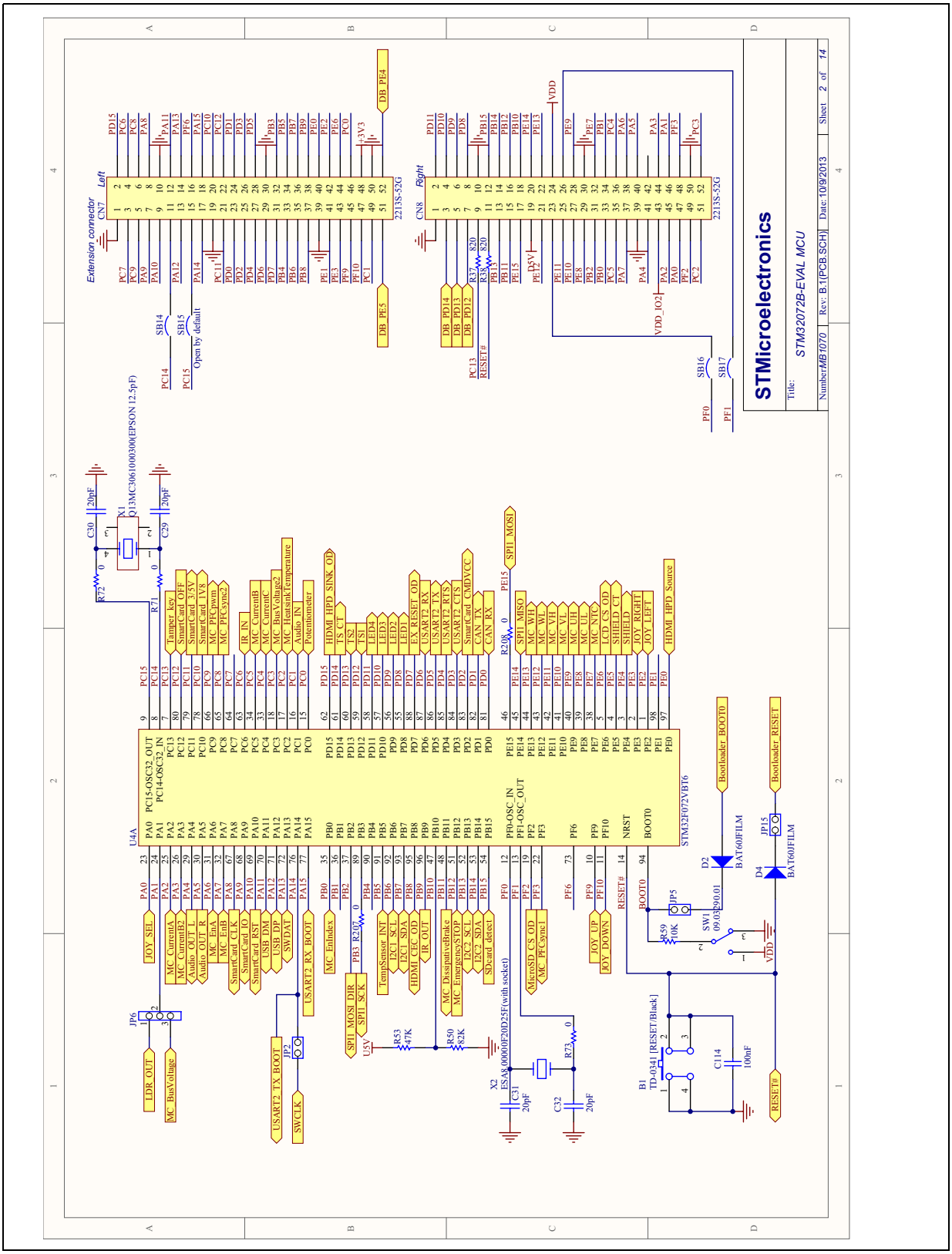


Figure 21. STM32072B-EVAL schematic 3

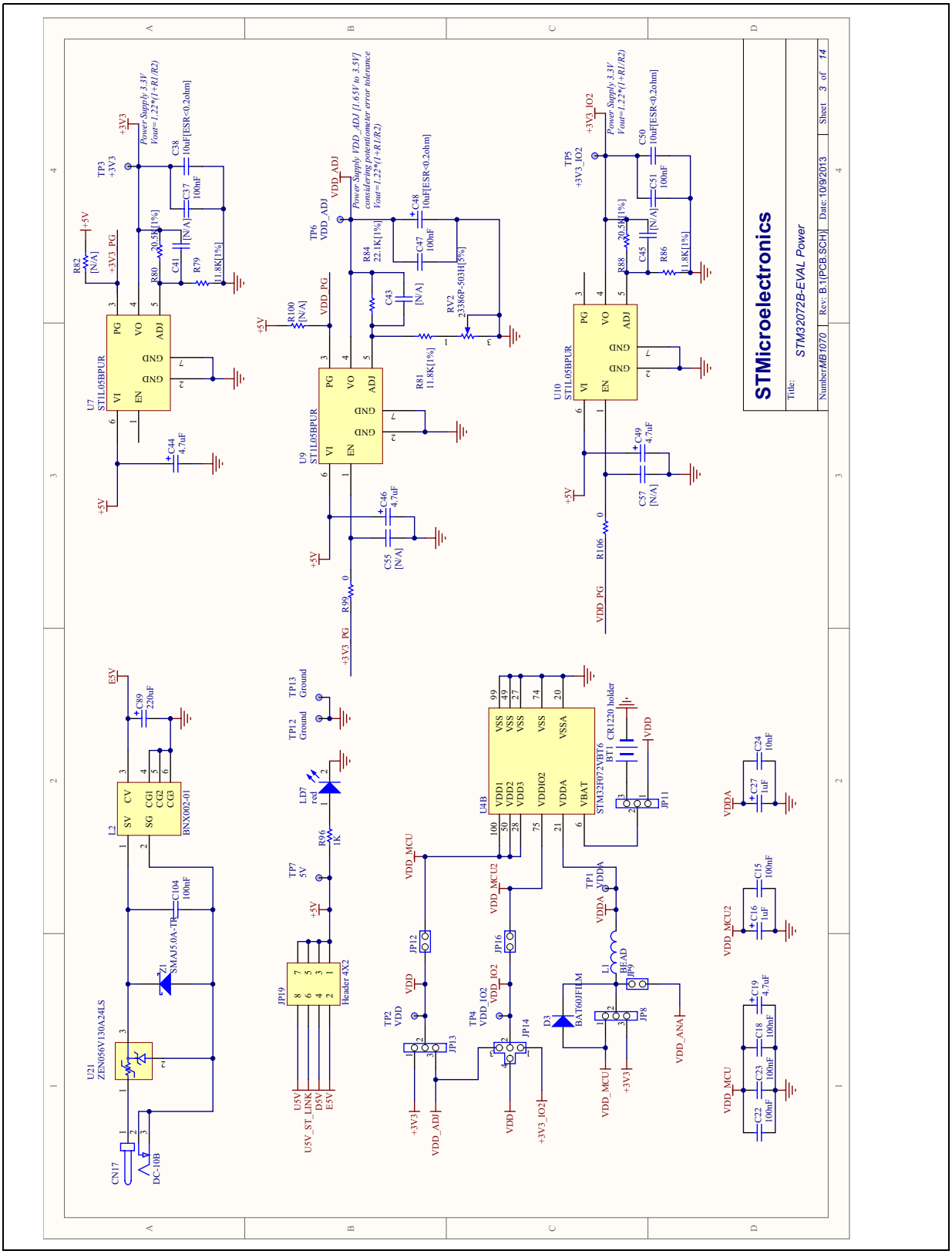


Figure 22. STM32072B-EVAL schematic 4

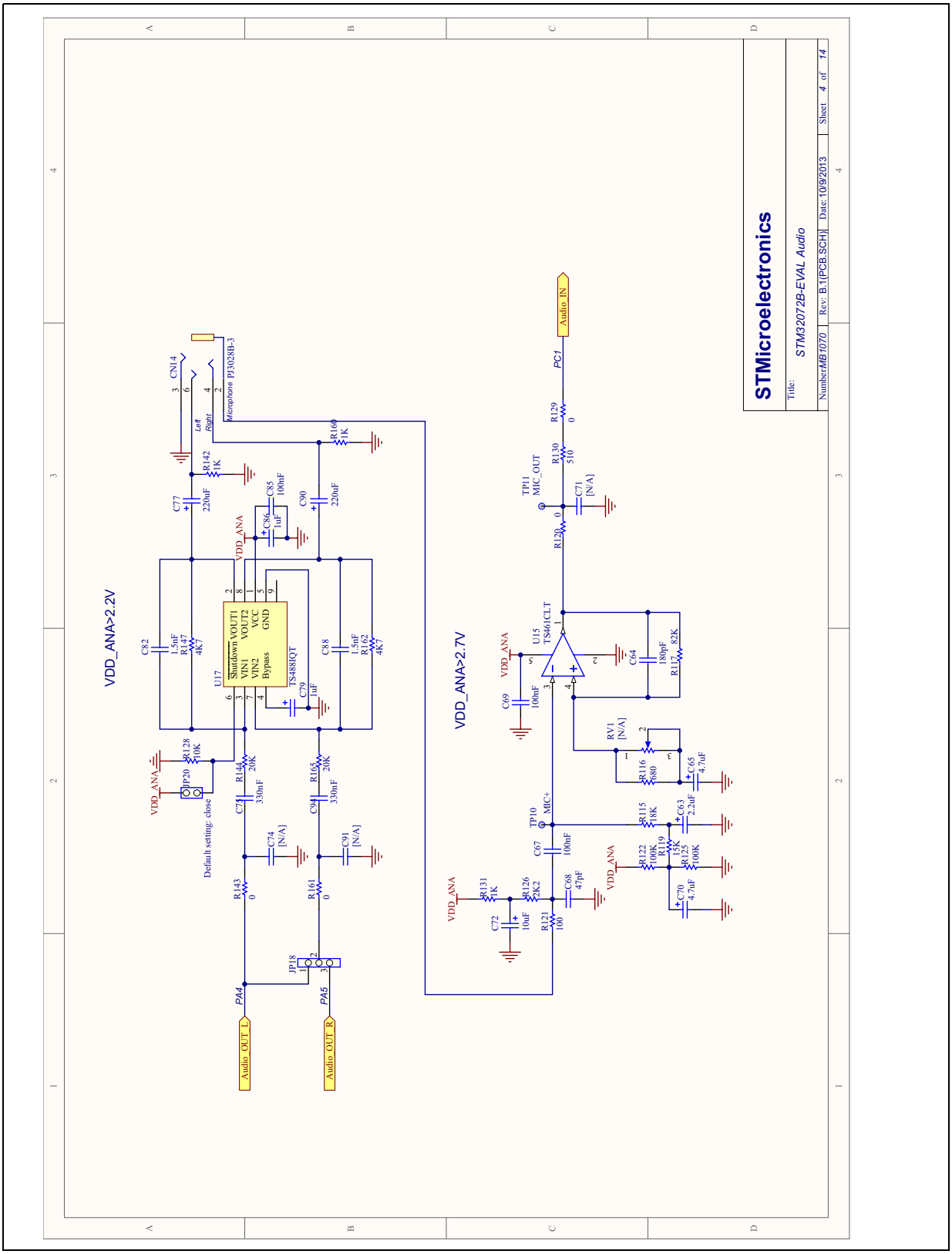


Figure 23. STM32072B-EVAL schematic 5

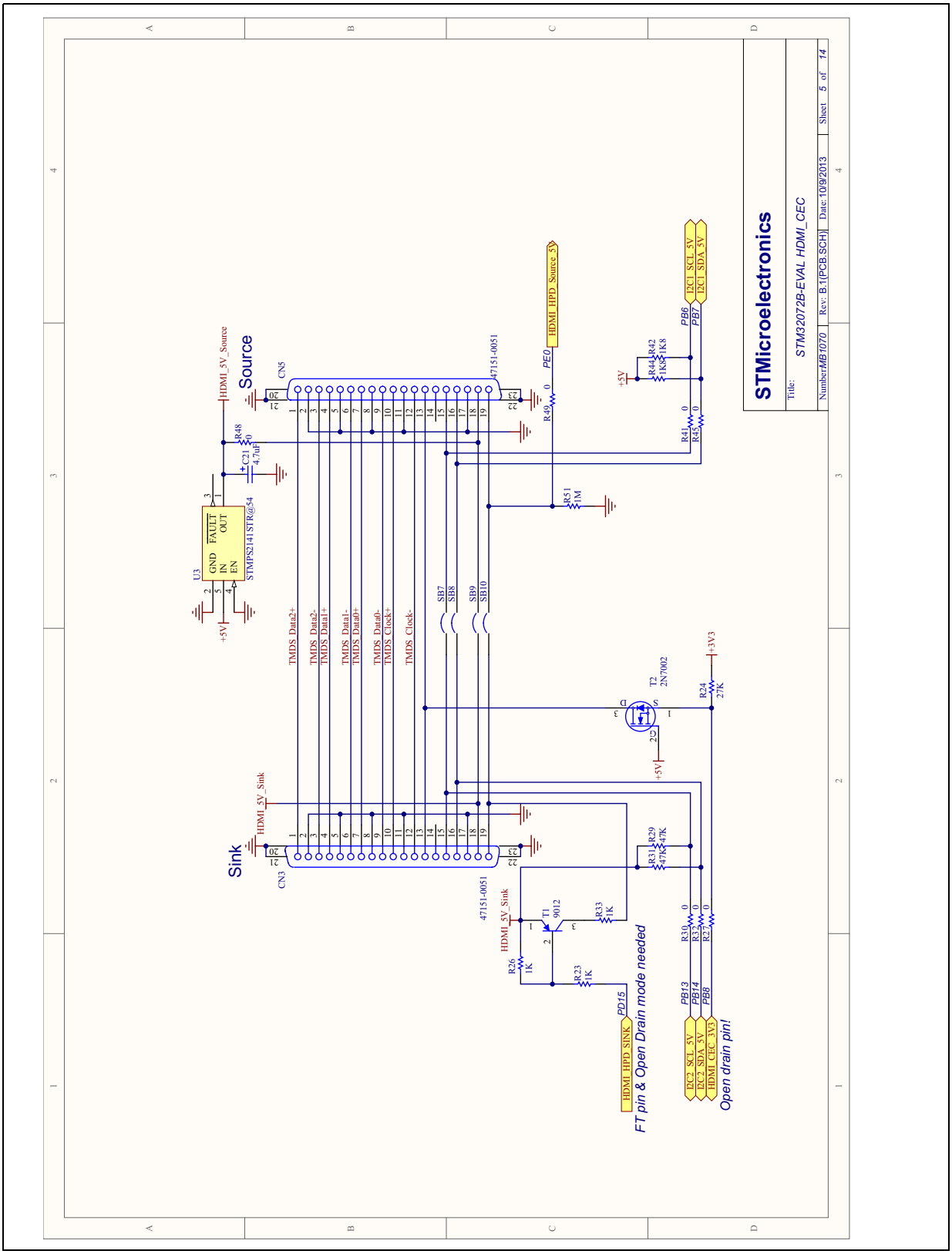


Figure 24. STM32072B-EVAL schematic 6

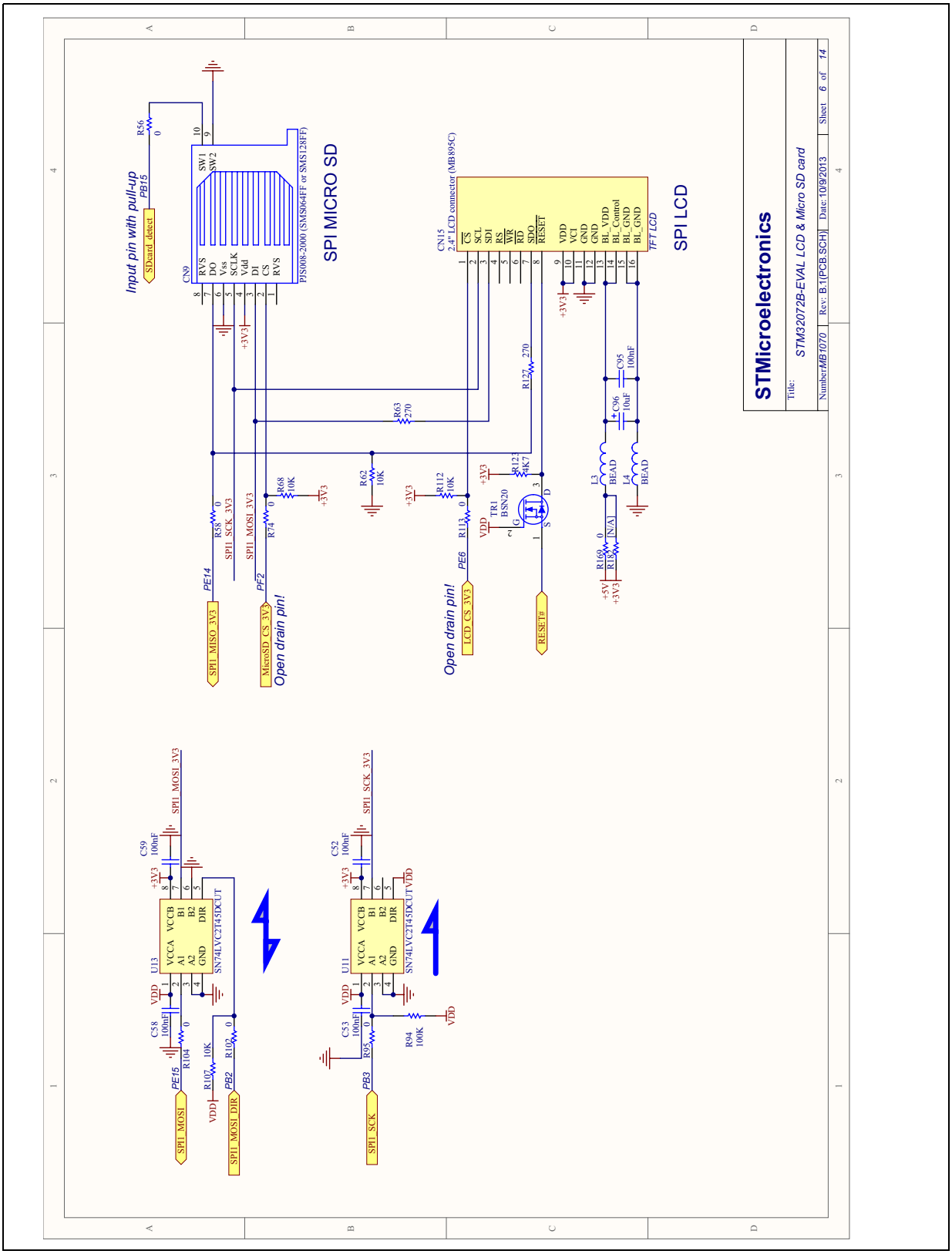


Figure 25. STM32072B-EVAL schematic 7

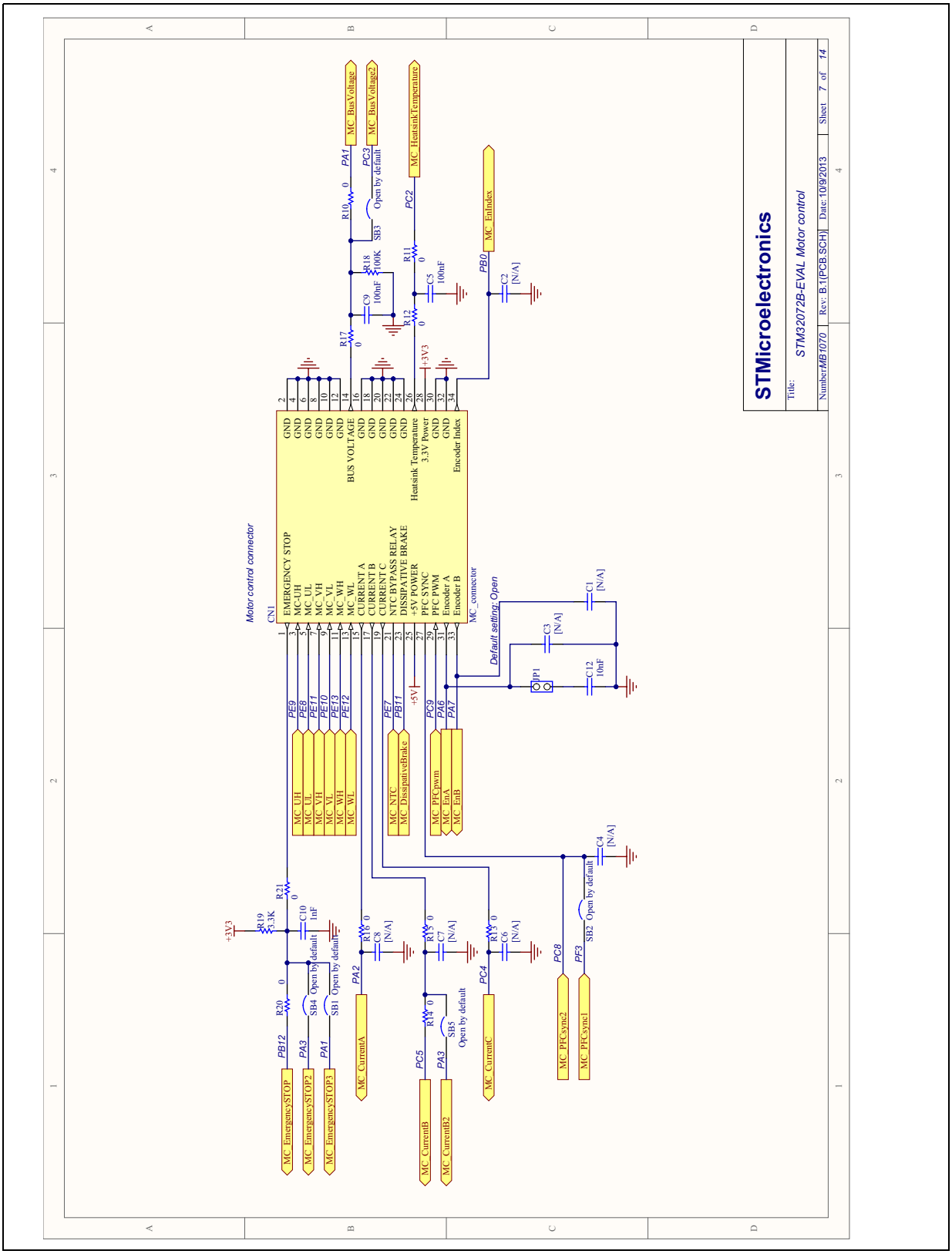


Figure 26. STM32072B-EVAL schematic 8

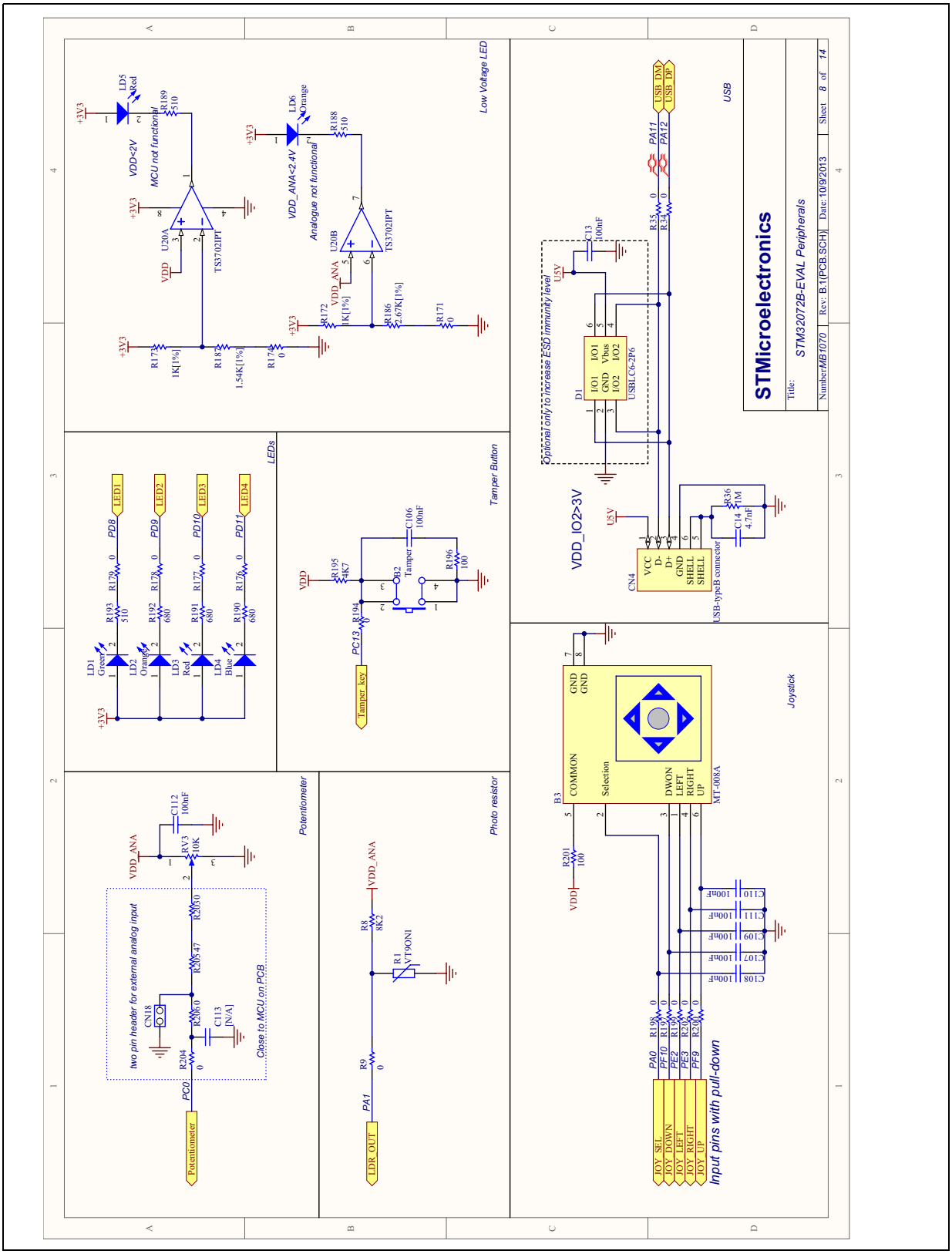


Figure 27. STM32072B-EVAL schematic 9

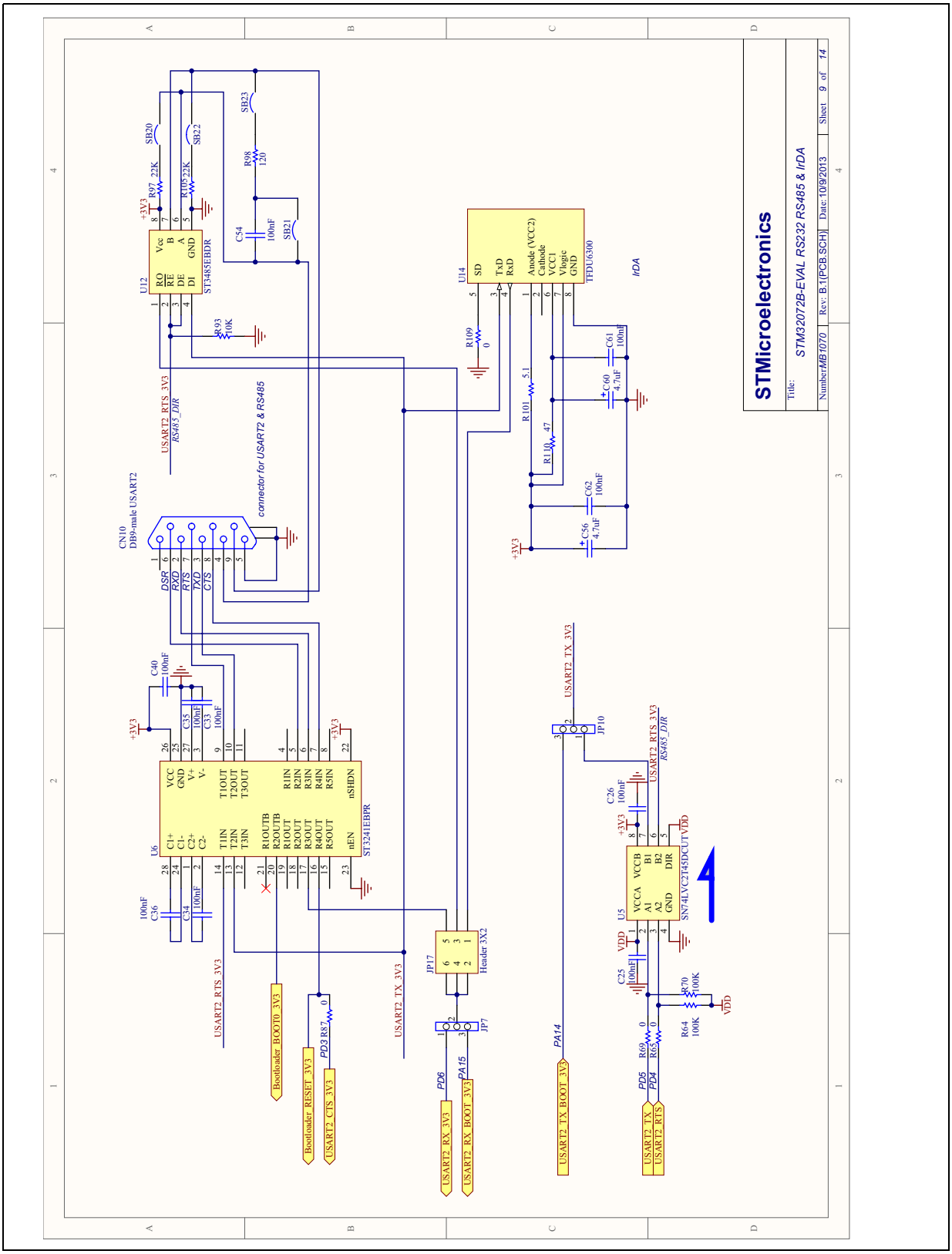


Figure 28. STM32072B-EVAL schematic 10

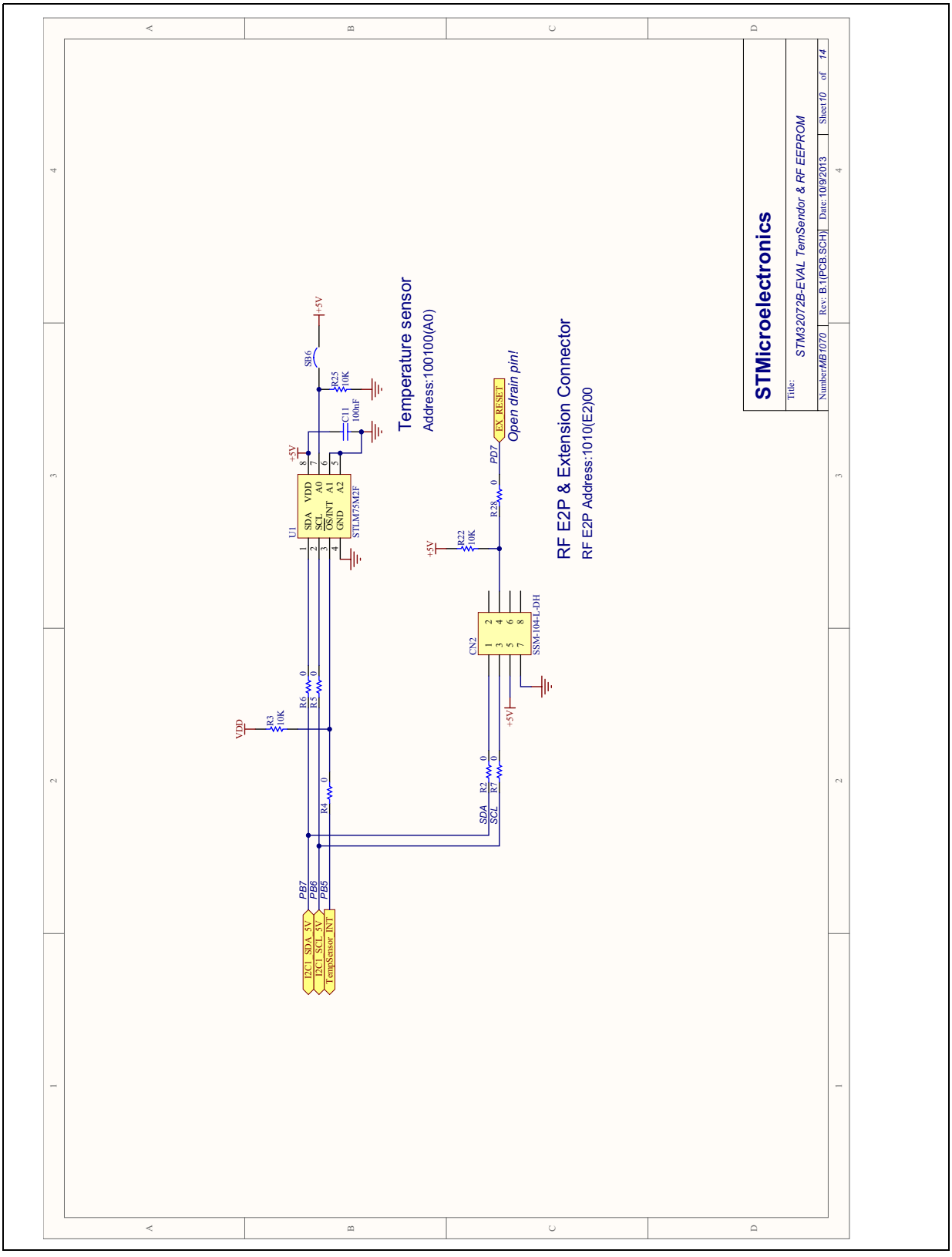


Figure 29. STM32072B-EVAL schematic 11

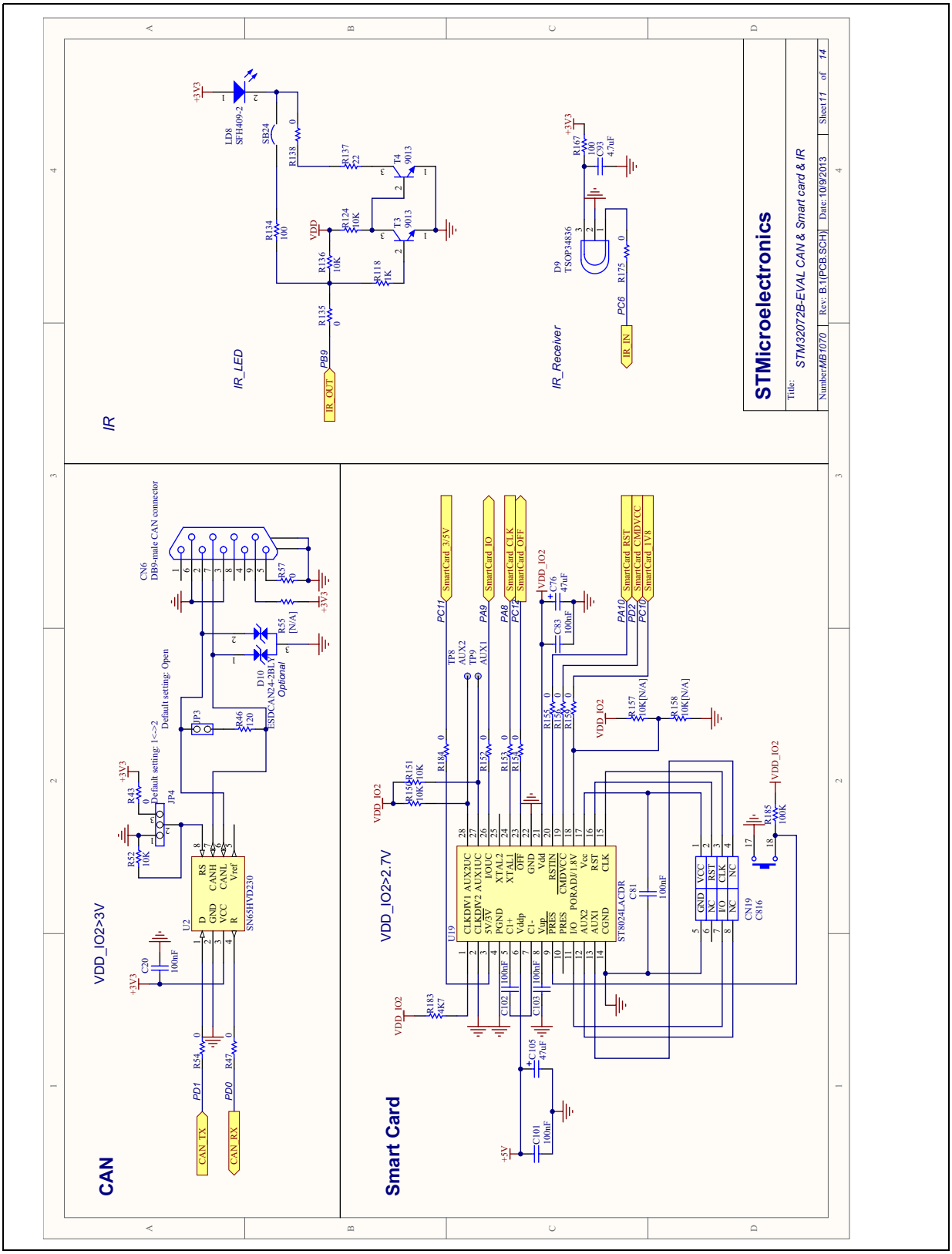


Figure 30. STM32072B-EVAL schematic 12

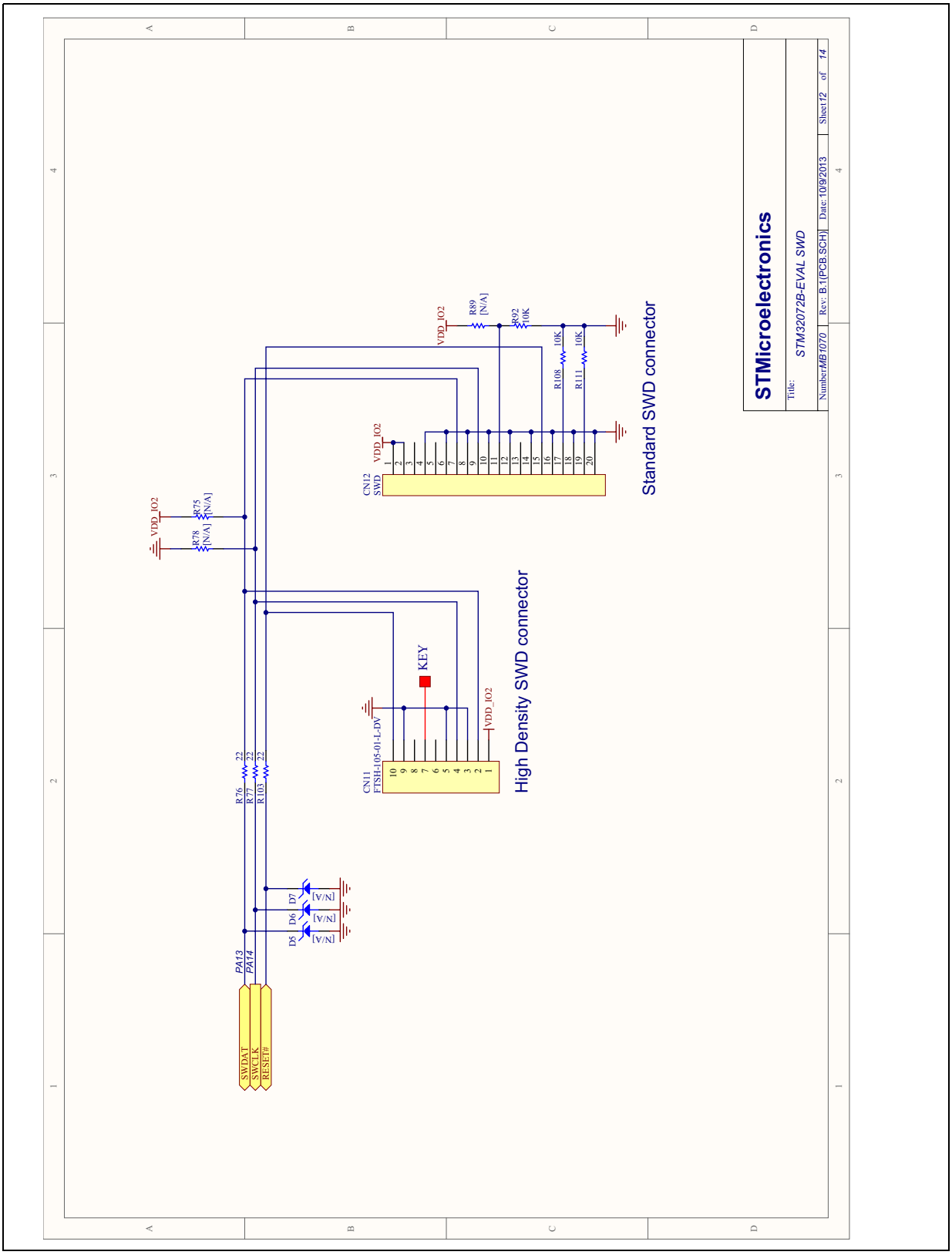


Figure 31. STM32072B-EVAL schematic 13

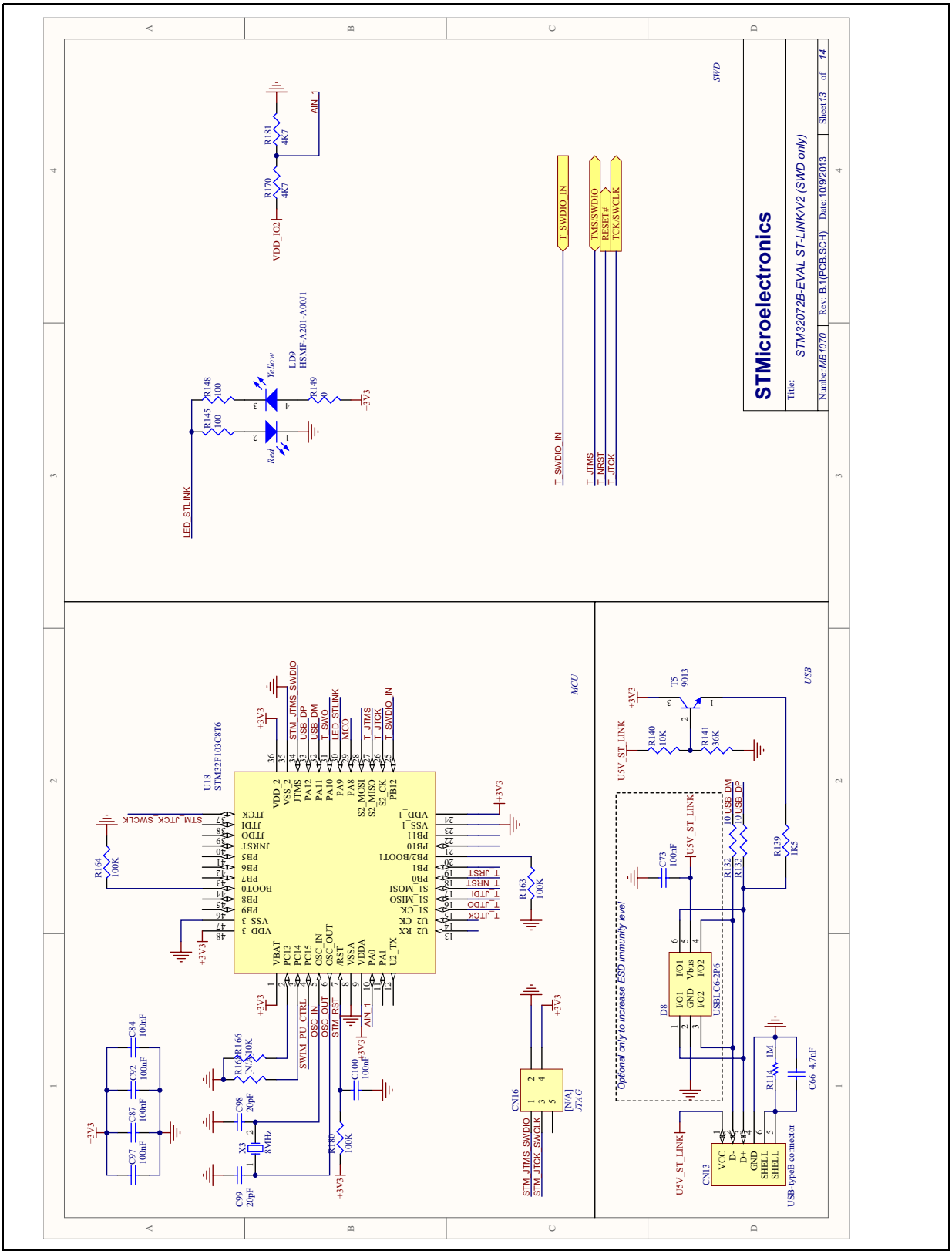


Figure 32. STM32072B-EVAL schematic 14

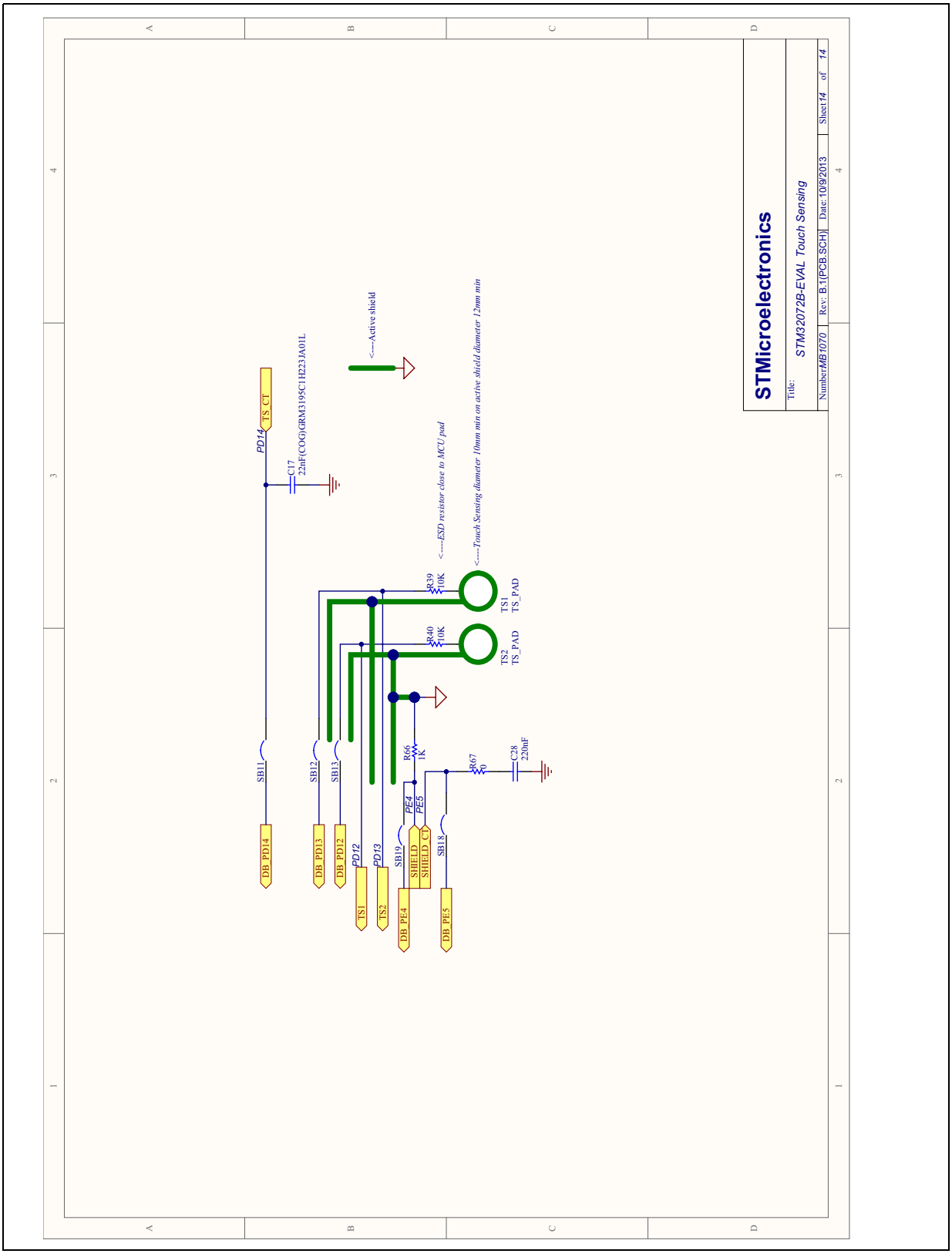
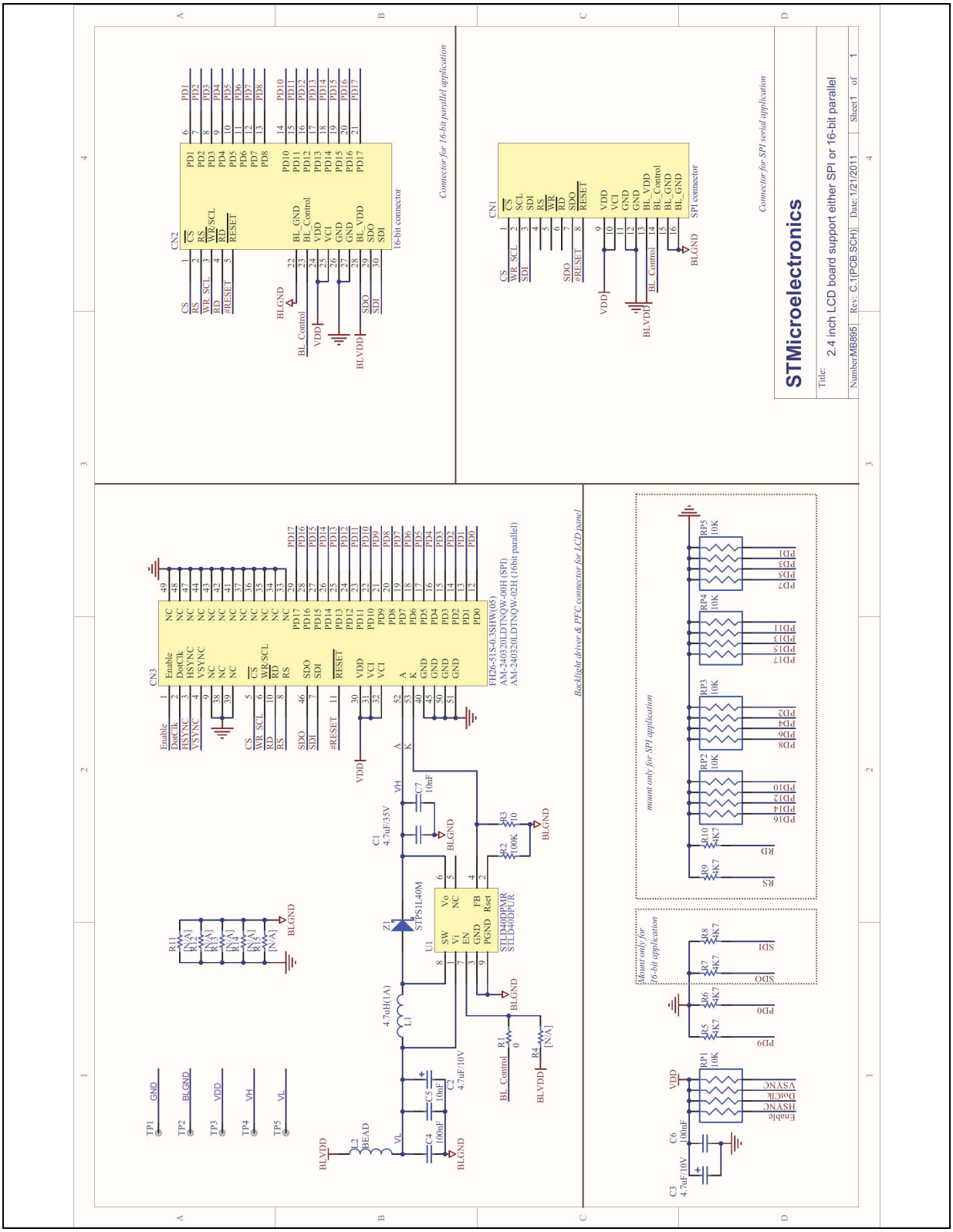


Figure 33. TFT LCD daughter board MB895



Appendix A STM32072B-EVAL IO assignment

Table 34. STM32072B-EVAL IO assignment

Pin No.	Pin name	STM32072B-EVAL general IO assignment	STM32072B-EVAL motor control IO assignment
1	PE2	JOY_LEFT	
2	PE3	JOY_RIGHT	
3	PE4	SHIELD	
4	PE5	SHIELD_CT	
5	PE6	LCD_CS	
6	VBAT	VBAT	
7	PC13	TAMPER_KEY	
8	PC14-OSC32_IN	OSC32_IN	
9	PC15-OSC32_OUT	OSC32_OUT	
10	PF9	JOY_UP	
11	PF10	JOY_DOWN	
12	PF0-OSC_IN	OSC_IN	
13	PF1-OSC_OUT	OSC_OUT	
14	NRST	NRST	
15	PC0	Potentiometer	
16	PC1	Audio_IN	
17	PC2		MC_headsinkTemp
18	PC3		MC_BusVoltage2
19	PF2	MicroSD_CS	
20	VSSA		
21	VDDA		
22	PF3		MC_PFCsync1
23	PA0	JOY_SEL	
24	PA1	LDR_OUT	MC_BusVoltage / Emergency_STOP3
25	PA2		MC_Current A
26	PA3		MC_Current B2/ Emergency_STOP2
27	VSS_3		

Table 34. STM32072B-EVAL IO assignment (continued)

Pin No.	Pin name	STM32072B-EVAL general IO assignment	STM32072B-EVAL motor control IO assignment
28	VDD_3		
29	PA4	Audio_OUT_LEFT	
30	PA5	Aduio_OUT_RIGHT	
31	PA6		MC_Encoder A
32	PA7		MC_Encoder B
33	PC4		MC_Current C
34	PC5		MC_Current B
35	PB0		MC_Encoder index
36	PB1		
37	PB2	SPI1_MOSI_DIR	
38	PE7		MC_NTC
39	PE8		MC_UL
40	PE9		MC_UH
41	PE10		MC_VL
42	PE11		MC_VH
43	PE12		MC_WL
44	PE13		MC_WH
45	PE14	SPI1_MISO	
46	PE15	SPI1_MOSI	
47	PB10	USB_VBUS_detection	
48	PB11		MC_DissipativeBrake
49	VSS_2		
50	VDD_2		
51	PB12		MC_EmergencySTOP
52	PB13	I2C2_SCL	
53	PB14	I2C2_SDA	
54	PB15	SDcard_detect	
55	PD8	LED1	
56	PD9	LED2	
57	PD10	LED3	
58	PD11	LED4	
59	PD12	TS1	

Table 34. STM32072B-EVAL IO assignment (continued)

Pin No.	Pin name	STM32072B-EVAL general IO assignment	STM32072B-EVAL motor control IO assignment
60	PD13	TS2	
61	PD14	TS_CT	
62	PD15	HDMI_HPD_Sink	
63	PC6	IR_IN	
64	PC7		
65	PC8		MC_PFCsync2
66	PC9		MC_PFCpwm
67	PA8	SmartCard_CLK	
68	PA9	SmartCard_IO	
69	PA10	SmartCard_RST	
70	PA11	USB_DM	
71	PA12	USB_DP	
72	PA13	SWDAT	
73	PF6		
74	VSS		
75	VDDIO2		
76	PA14	SWCLK / USART2_TX_BOOT	
77	PA15	USART2_RX_BOOT	
78	PC10	SmartCard_1V8	
79	PC11	SmartCard_3/5V	
80	PC12	SmartCard_OFF	
81	PD0	CAN_RX	
82	PD1	CAN_TX	
83	PD2	SmartCard_CMDVCC	
84	PD3	USART2_CTS	
85	PD4	USART2_RTS / RS485_DIR	
86	PD5	USART2_TX	
87	PD6	USART2_RX	
88	PD7	EX_RESET	
89	PB3	SPI1_SCK	
90	PB4		
91	PB5	TempSensor_INT	

Table 34. STM32072B-EVAL IO assignment (continued)

Pin No.	Pin name	STM32072B-EVAL general IO assignment	STM32072B-EVAL motor control IO assignment
92	PB6	I2C1_SCL	
93	PB7	I2C1_SDA	
94	BOOT0	BOOT0	
95	PB8	HDMI_CEC	
96	PB9	IR_OUT	
97	PE0	HDMI_HPD_Source	
98	PE1		
99	VSS_1		
100	VDD_1		

Appendix B Mechanical dimensions

Figure 34. STM32072B-EVAL mechanical dimensions

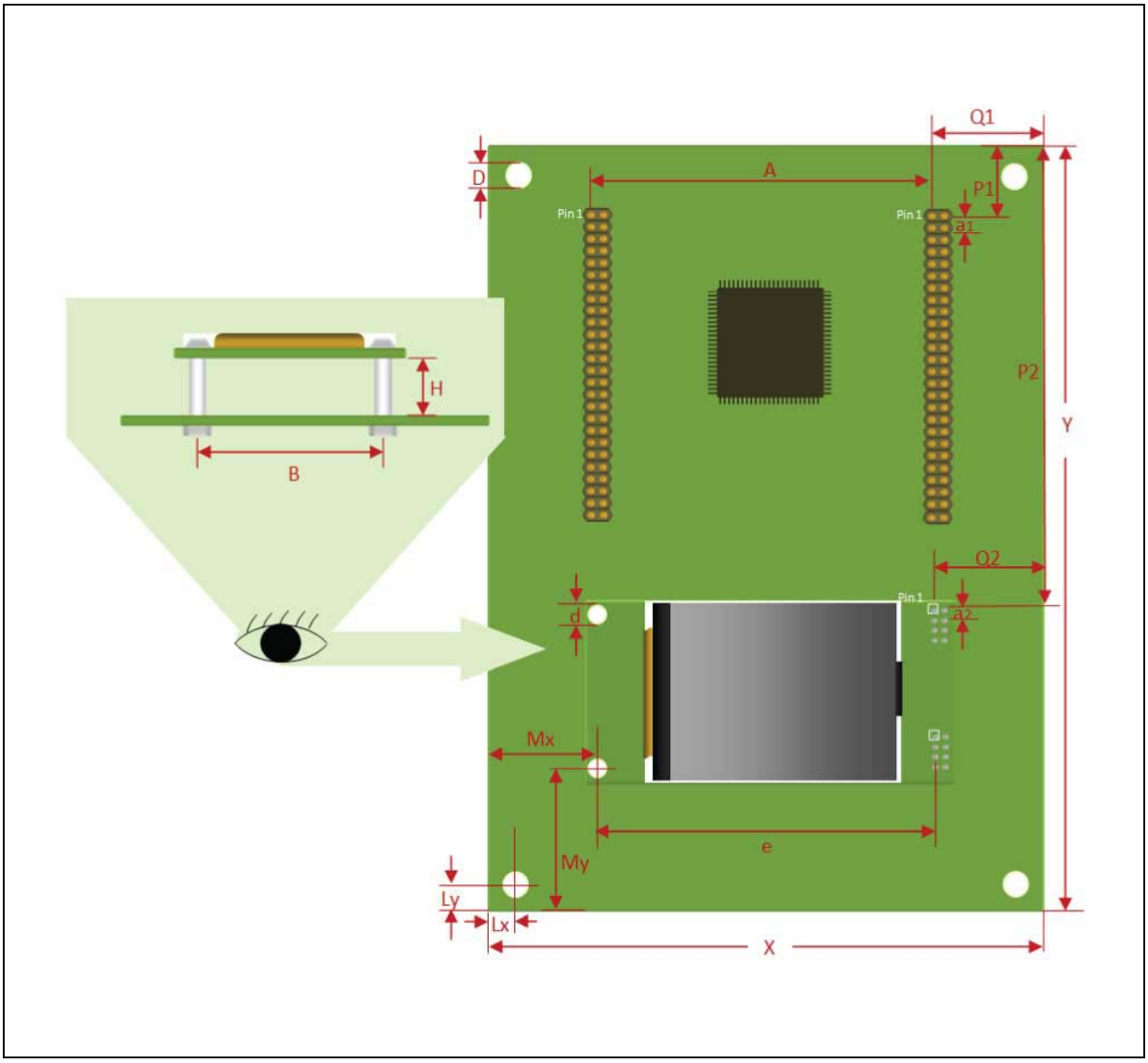


Table 35. STM32072B-EVAL mechanical dimensions

Symbol	Size (mm)	Symbol	Size (mm)	Symbol	Size (mm)
A	68.58	e	77.44	P1	26.67
a1	2.54	H	11	P2	111.76
a2	2.54	Lx	5.715	Q1	24.12
B	36	Ly	5.715	Q2	17.70
D	3.5	Mx	19.08	X	114.3
d	3.2	My	23.81	Y	172.72

Revision history

Table 36. Document revision history

Date	Revision	Changes
13-Jan-2014	1	Initial release.

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